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A New Foundry Process

It does not often happen that we have to record a new process for the production of castings. By this statement we mean the actual production of castings either by the use of new methods or materials, and not ancillary processes such as melting, drying or cleaning. The latest process is at present confined to the production of brass castings and utilises plaster moulds, constructed according to a group of Patents issued to the Castings Patent Corporation of Chicago and known as the Capaco process. We should have hesitated to give such prominence to the process were it not for the fact that the internationally known firm of Briggs Manufacturing Company of Cleveland must have spent many thousands of pounds in equipping a brand new foundry specially to operate the process, and is turning out something of the order of ten tons per day of quite small castings. The equipment used is radically different from any previously described in the technical Press. It is through the courtesy of the Editor of "The Iron Age" that we are able to give the following details. The material used consists of about 79 per cent. of calcined calcium sulphate—a form of commercial gypsum—20 per cent. of magnesium silicate—a fibrous reinforcement—and one per cent. of a "devil's brew" that accelerates the setting of the mixture. The ingredients are mixed dry on an upper floor of the foundry buildings, and then chemically pure water is added from a purifying plant situated adjacent to the mixture, making use of a second mixer. This plant is located immediately above the pattern, mounted on a vibrating unit. The pattern or die is combined with a snap flask and is 12 in. wide by 18 in. long, and is divided into 20 equal sections carrying removable patterns. These boxes start their foundry life in the upside-down position on a stand for receiving a spray coating; a simple turnover machine connects the spray station with vibrating units. The water content added to the mixture controls, apparently to fairly fine limits, the permeability of the mould, a void space of 1:5 being standard practice. The flask, being filled, is pushed on to a circular table, the perimeter of which carries an electrically heated tunnel, controlled at 160 deg. F. On emerging, the flask passes on to a turnover machine and then to a mould-extracting machine, which utilises a magnetic chuck for effecting the separation. The mould, now in a plastic state, is then pushed on to a transfer truck and elevated, resting on a plate to the mould-drying oven, 74 ft. long, divided into two zones. The first zone is held at 785 deg. C. and the second from 230 to 260 deg. C., and the time for the passage of the mould is 20 min. in the first and 80 in the second. After baking, the moulds are cored up, the cores being made by somewhat similar equipment, except that a vertical "setting" stove is used instead of the "tunnel table." A conveyor takes the carrier plates back to the transfer truck. A special set-up has been designed for the holding of the moulds for casting, and the transference on trucks to the first floor; the passage along the cooling beds; the knock-out; the washing; inspection sorting; gate removal; packing and despatch are mechanised wherever possible. The used plaster is conveyed overhead for disposal.

It now remains to consider the competitive position of the process. Its main advantage appears to be in the reduction of dimensional tolerances, which approximate those to be associated with die casting. It has established itself in four foundries, where the bulk of the castings being made are brass. The upper limit of the pouring temperature is 1,260 deg. C., which makes the use of the Capaco process of doubtful utility for grey iron. The only information as to its applicability to light alloys is that it has been the subject of experiments by one aircraft manufacturing concern, which decided to adhere to sand castings. Other factors are that any lead addition must not exceed 6 per cent.; manganese bronze, silicon bronze, yellow brass and aluminium bronze cast well, but red brass and gunmetal are inclined to show less satisfactory results.

We have seldom encountered a new process carrying so many claims to novelty and so few to commercial economies, which is obviously doing excellent work in a somewhat restricted, though very important, field.

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Progress in Scrap Control

BY "ONLOOKER."

The second half of this year has seen a big move forward in the task of setting in order the scrap situation and marshalling our supplies of secondary metals in order that the best possible use may be made of this essential raw material. For many months there was evidence that a sense of disquietude was felt among metal people who believed that stocks of scrap were increasing unduly without the necessary parallel action being taken by the authorities. In the summer a marked downward reaction was seen in the market quotations of many grades of scrap, particularly in brass, and this development gave point to the contention that undue accumulations were in existence. It was known that swarf from fuse rods and similar products had been piling up for some time, but when it became evident that high-grade brass, too, was being sold at prices much below its intrinsic value, action by the Control was inevitable.

In some directions there had been an outcry because the recession in values had carried prices a long way below the permitted maximum quotations listed in the Ministry of Supply Order (No. 5), 1939, but consumers generally welcomed this break, for they were of the opinion that in practice they had paid over a period of nearly two years too dearly for the secondary metals which many had absorbed so freely.

Co-operation with Trade

In order to overtake the work connected with the straightening out of the situation which had developed, the Control established a special department and invited the co-operation of the trade in the solution of the problems which had to be faced. Discussions took place and the preliminary shots in the campaign were fired when instructions went out to manufacturers of extruded brass rod asking them to utilise not less than 33⅓ per cent. swarf in the casting of billets for the production of material to B.S.S. 249 and not less than 15 per cent. in B.S.S. 218. This, it was felt, would go a long way towards absorbing the swarf arising from current manufacture of components, but naturally some time must elapse before it can be ascertained how this scheme will work out. The main plan devised by the Control for getting things shipshape on the scrap metal side took cognisance of the two chief divisions of "process" material and "collected" scrap. In the former comes all the waste produced during manufacturing operations, and in the latter the output from those firms engaged in breaking down worn-out or redundant plant, machinery and installations, as well as old domestic utensils, etc. To deal with the arisings in the first section, an intimation was sent to the rolling mills that they should arrange to take back from their customers all the webbing scrap accruing during their process of manufacture. Further, it was stated that all other types of process scrap should in the first place be offered to the supplier of the metal and that he should, if at all possible, buy it. If this scrap is not acceptable to the manufacturer, the Control should be informed and would then instruct the owner of the scrap how to dispose of it.

With regard to purchases of secondary material by consumers, a monthly return is now made to the Control giving a description of the parcel acquired, and in the case of process scrap the town or county of origin. In this way the Control is put into possession of a mass of information which will be of great use in arranging for the most economical flow of secondary metal in this country. In the early stages of these schemes difficulties are bound to crop up, but there cannot be any doubt that the Control is tackling a difficult problem in a manner that promises success.

Durability of Basic O.H. Furnace Roofs

CO-OPERATIVE OBSERVATIONS

The results of observational work on the roof of a basic open-hearth steel furnace are given in a report, "A Co-operative Investigation of the Factors Influencing the Durability of the Roofs of Basic Open-Hearth Furnaces," by the Open-Hearth Refractories Joint Panel, working under the ægis of the Iron and Steel Industrial Research Council and the Council of the British Refractories Research Association. The observations commenced with the raw materials from which the silica roof was made, and ended with laboratory work on samples taken from the roof at the close of the campaign. During the campaign itself a pyrometric record was made of the temperature at the surface and at various levels within the roof. The raw quartzite contained a proportion of comparatively large grains which were more readily converted than the remainder of the rock; this was attributed to strain within the lattice. The amount of tridymite produced in the fired product was to some extent dependent on the fineness of grinding.

On warming-up an open-hearth furnace, care must be taken in controlling the pull of the stack; if the stack damper is suddenly opened before gassing, the temperature of the roof may fall 200 to 300 deg. C. in a few minutes. The readings of the radiation pyrometer focused on the roof in a large measure confirm the findings of American workers; in particular, temperature fluctuations of the order of 300 deg. C. occurred during charging. In addition to these violent changes in temperature, however, fluctuations of about 50 deg. C. occurred at each reversal; these variations were substantiated by thermocouple readings.

"Seasoning" of the Roof

The pyrometer record served to show that during the first two weeks of the campaign the temperature gradient near the hot face became greatly modified; this effect is assumed to be associated with the "seasoning" of the roof. Other important factors bound up with seasoning may be the marked decrease in porosity and the slight increase in refractoriness of the cristobalite zone. At a later stage in the campaign the roof became hotter at the tapping than at the charging side.

Sampling of the dust and slag carried by the waste gases confirmed that the furnace atmosphere is most dusty during charging; at this period the dust consists mainly of lime, but during melting iron oxide preponderates. The zonal appearance of the used roof bricks was normal, but analysis showed that the iron oxide content of the cristobalite zone was a little higher than that of the tridymite zone, while the lime had concentrated nearer to the hot face than the pale-yellow zone usually assigned to it. This zone was almost impermeable, owing to a narrow band of calcareous glass; its refractoriness was 1,640 deg. C. when powdered and rebonded. Several samples had cracked laterally in the region of this glassy band. The high temperature attained by the brickwork when a charge foams and the deleterious influence of foaming on the refractories have been confirmed.

The report consists of a foreword written by Dr. T. Swinden and six sections; it was presented as a Paper at the recent Autumn Meeting of the Iron and Steel Institute.

DON'T WASTE PAPER—IT IS A VITAL WAR MATERIAL

Random Shots

Although to most people this Christmas the annual turkey will take the modest form of turkey and ham paste for tea, it is with gratitude in the heart that one remembers the glories of past Christmas feasts, with the proud moments when the noble bird is brought in by a triumphant cook and later when a rich and flaming pudding makes its appearance on the table with all due ritual. It is even more interesting to read of the reverence almost with which connoisseurs of former times treated the culinary art. This is what Charles Lamb wrote to a friend upon the subject of a pig which the friend had enjoyed in fact and Lamb in the mere thought of it. "It gives me great satisfaction to hear that the pig turned out so well. You had all some of the crackling and brain sauce? . . . . Did you remember to rub it with butter and gently dredge it a little, just before the crisis? Did the eyes come away kindly with no Œdipan avulsion? Was the crackling the colour of the ripe pomegranate? Had you no complement of boiled neck of mutton before it, to blunt the edge of delicate desire? Did you flesh maiden teeth in it?"

* * *

It is also not without its humour now to read of a letter which was written from the fashionable town of Bath in the early eighteen hundreds. "A dreadful controversy has broken out in Bath," writes the Rev. Sidney Smith to Lady Holland, "whether tea is most effectually sweetened by lump or pounded sugar; and the worst passions are called into action by the pulverists and the lumpists. I have been pressed by ladies on both sides to speak in favour of their respective theories, at the Royal Institution, which I have promised to do."

* * *

Mr. A. H. Dix, of the "Iron Age," will appreciate the suggestion (being the product of a child's mind and therefore bearing no malice!) that the title of his column is not merely a *double-entendre*, but has a possible third interpretation. Being an inveterate searcher after "anything funny," this youngster always looks for "Fatigue Cracks."

"Peculiar title, I think," he remarked on picking up the latest issue.

"Actually, it is a very clever one," replied his father, who went on to explain the metallurgical meaning and how in this sense it means jokes (or cracks) for the tired mind.

"Or, alternatively," said the youngster, becoming quite intrigued with the idea of double senses, "perhaps it means jokes that make you tired?"

Thank heaven, America is several thousands of miles away!

* * *

Mr. Percy Pritchard expressed the thought recently that what is wanted in official circles is an odd "yes man" or two; Whitehall seems to be full of "no men." In this thought many will agree with him; he is not the only business administrator who, like a child in a "repressed" home, when nurse and parents alike have said once too often, "Don't do that," feels like shouting at the top of his voice, "Well, what *can* I do, then?"

* * *

The modern definition of an ill-mannered person is one who leans over the counter and, *sotto voce*, says to the grocer, "What have you got that's scarce?"

"MARKSMAN."

B.S.991—*Data on Cast Iron.*—In last week's leader reviewing the above new publication of the British Standards Institution, the address of the Institution was given incorrectly and should have been 28, Victoria Street, London, S.W.1.

Some Fundamental Aspects of Foundry Sands

By E. J. ASH and E. O. LISSELL, University of Michigan

(An Annotated Abstract by Wm. Y. Buchanan)

In the July and August issues of "The Foundry," PROF. ASH and MR. E. O. LISSELL detailed some original researches, using many of the concepts created by Mr. Buchanan. We therefore asked Mr. Buchanan to prepare an annotated abstract in order to maintain continuity of thought on this very important subject.

So far as one can see there has been little or no serious attempt in this country to understand the inherent limitations of the A.F.A. method of making the sand test-piece, and indeed where anything has been written on the subject here, every effort has been made to excuse the necessity for such a study on the ground that such limitations or defects simply cannot exist, and their discussion or investigation should be avoided. For example, the only reference one finds to this fundamentally important matter in the British Exchange Paper to the A.F.A. (see FOUNDRY TRADE JOURNAL, May, 1940), describing activities in the development of sand control in Britain, is a vague statement that progress has been held up by endless argument on test-piece sizes and method.

This is not strictly true, as the statement of well-authenticated work clearly illustrating these

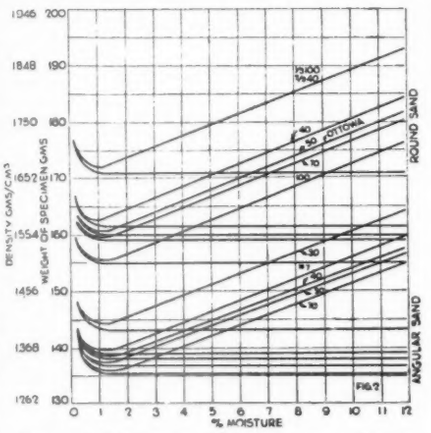

FIG. 1.—MOISTURE CONTENT AND GREEN APPARENT DENSITY OF BOTH ROUND AND ANGULAR GRAINS.

defects and their misleading influence on some published work on sand on the one hand, was not met on the other hand by any research work in this country to prove the contrary. It is true that a special Joint Committee on Sands was set up in England following the writer's Birmingham Paper, 1938, "with the sole object of correlating test methods," but whether it has evolved anything new or considered the data already published is not clear, as nothing has been published.

A New Start

It is therefore gratifying to read of the work of Prof. Ash and E. O. Lissell carried out in Michigan University, in which nothing has been taken for granted and the secondary factors carefully eliminated in order to take one variable at a time. If work of this kind is continued, a satisfactory basis for testing should not be difficult to achieve, and that in a very short time.

In the report of this work exception may be taken to the fact that clay-free sand will not behave in the same way as moulding sand, but the authors do not attempt to predict the behaviour of moulding sand from the results obtained on washed sand.

During the discussion on the present writer's Paper given at Birmingham in April, 1938, it was asked how a comparison could be made at the same index of ramming between sand of different grain size or distribution, as though it were expected that this system should create a state where the grains would be virtually made uniform in size. Nothing can, of course, do this unless the large grained sand be broken down, all the sieve fractions separated in the case of both sands under comparison, and then these blended by weight. This would naturally be absurd. When sands are tested, it is intended to evaluate their properties in the exact condition in which they are received to see whether they can be used as received and perhaps re-tested after treatment, but in no case is it part of the testing procedure to alter the constitution of the representative samples.

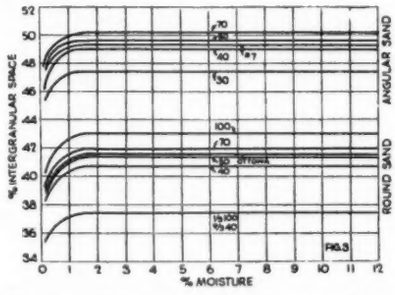

FIG. 2.—RELATIONSHIP BETWEEN INTERGRANULAR SPACE AND MOISTURE CONTENT.

Index of Ramming

The point raised by this question is satisfactorily answered by the work of Prof. Ash and Mr. Lissell. This research, which is to be dealt with in some detail, tells how a number of separate sieve fractions were rammed in the A.F.A. ramming apparatus. These were found to ram to a different degree, *i.e.*, a different I. of R., in the A.F.A. rammer, or, in other words, if compared at a constant I. of R. number, the effect of breaking down the grains, thus increasing their surface area and altering their condition, would be measurable, while the corresponding A.F.A. test would show the combined effect of this change of grain size and the change in ramming of the A.F.A. rammed test-piece due to change of flowability in the sand, which in turn would be dependent on change in grain size, surface condition, etc.

The Index of Ramming method is not intended to replace the A.F.A. method of making the test, but to be used as a complementary method. By having a more scientific background for comparison, the A.F.A. method would be made much more valuable, since the amount of energy absorbed by a specific sand during ramming would be found.

Untenable Suggestions

The following notes bear out this contention, and is the first sign of a more enlightened era which the present writer has looked forward to as a pleasant change from the constant advocacy for the "intelligent labourer" type of foundry control personnel, which many people for a number of years seemed to visualise as the only type likely to be available and for whom the whole system of sand testing was to be made easy. After all, one might well ask: "What is an intelligent labourer?"

Another comment which was made in a discussion on the present writer's suggested method of testing was that one speaker "thought there was a possibility that founders might be led astray *by too much scientific care* in sand testing." No statement could be found which, if taken seriously, is better calculated to retard progress. Everyone will admit that the time when industry will thrive on the old slapdash methods is gone and scientific care is not only essential to further progress, but also to maintain industry at its present standard. It would seem that this tendency to discount "scientific care" might, with more justification, be claimed as the real cause of delay in progress.

In the haste to get to the control and direction of large-scale sand-treatment operations, the questions of fundamental soundness of the system are ignored as being too troublesome. This procedure savours of putting the cart before the horse, and, as is well known, the equipage, in this predicament, does not usually make much progress in the desired direction.

In the work of Ash and Lissell, in all calculations, it has been assumed that the density is uniform throughout the specimen. This

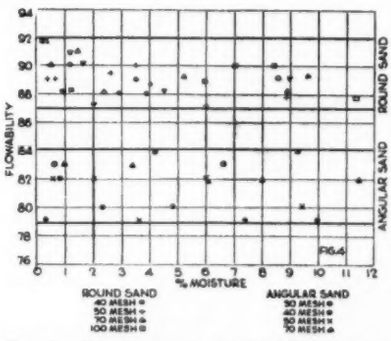

FIG. 3.—RELATIONSHIP BETWEEN FLOWABILITY AND MOISTURE CONTENT.

assumption is only possible in the circumstances of the research outlined, namely, with sands carefully washed and cleaned, thereby eliminating most of the factors controlling flowability during ramming of the test-piece in normal moulding sands.

The writer wishes to point out that the defects of the A.F.A. method are all connected with the inability to produce a test-piece of moulding sand uniformly rammed and of correct proportion in accurate duplicate, and that the flowability effect is an inherent characteristic of the method which can, and should, be turned to good account, and if used in conjunction with the Index of Ramming method, will give this valuable information in quantitative terms.

Why the Work was Undertaken

The article by Ash and Lissell begins with this statement:—

"Considerable criticism regarding the method adopted by the American Foundrymen's Association for preparing the standard compression test for sands has been offered by Buchanan, FOUNDRY TRADE JOURNAL, 1933 and 1937, and it is undoubtedly well founded and worthy of consideration in research work.

"Buchanan has pointed out that the A.F.A. method of test preparation is influenced by such factors as 'flowability, resistance to ramming, or internal friction' due to moisture changes

Fundamentals of Foundry Sands

in the sand. To these factors may also be added the influence of the amount and type of clay binder.

"The present investigation is an attempt to clarify the apparent deficiencies of the A.F.A. method through a study of factors which influence the ramming process, and better to understand its advantages and limitations.

"The primary factors of any sand are the shape, size and distribution of the grains, amount and type of clay, water content, and grain surface condition. Such properties as strength, permeability, flowability, etc., are secondary factors. This study shows the influence the primary factors have on the secondary factors when testing specimens prepared by the standard A.F.A. method.

"This present article deals with experiments to determine the effect of water on washed sand grains, both round and angular, with regard to permeability, density, flowability. This data on clay-free grains will serve as a basis or foundation for work to be reported in the second phase of this study, namely, the effect of varying amounts of clay, oil, and water."

Experimental Data

Ash and Lissell's work is based on tests of two sands, Ottowa sand, a typical round grained sand, and Ohio crushed silica sand, a typical angular sand. Great care was taken to eliminate clay by washing, and for further tests the sands were separated into sieve fractions for

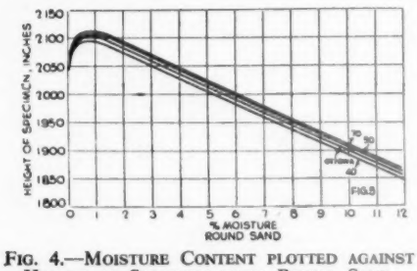

FIG. 4.—MOISTURE CONTENT PLOTTED AGAINST HEIGHT OF SPECIMEN WITH ROUND SAND.

individual testing, this giving a series of sands each of uniform grain size. For example 100, 70, 50, 40, 30 and possible mixtures of these.

The amount of rubbing imposed on the sand during mixing was found to have a pronounced influence on the degree of ramming, since the surface condition of the grains controlled the flowability of the sand during ramming in the standard A.F.A. rammer.

The length of the A.F.A. test-piece was carefully controlled to 2 in. ± 0.005 in., thereby reducing one common variable, and flowability values obtained by the method put forward by Dietert, namely, the change in length of the A.F.A. test-piece between the 4th and 5th blow.

Again quoting from the articles, Ash and Lissell state:—

"In this phase of study concerned with the grain moisture relationships, only permeability values will be considered. Under circumstances of this test, permeability is influenced by (1) actual amount of voids present; (2) actual surface area of grains; (3) shape of the voids, and (4) the surface condition of the sand grains. These factors will be influenced by the sand-water mixtures and ramming method used as follows:—(1) Sand, according to grain size, shape, and surface condition; (2) water, according to the amount and surface tension, and (3) degree of compression of the sample."

Table I shows the sieve analysis of the two sands used by the authors in their research.

Where British and American Test-pieces Differ

The article then goes on to consider the American standard method of making test-piece and the British method of making the same size of test-piece by compression to one or more standard densities as advocated by Buchanan, to form an independent system or, preferably, a composite system by using it in conjunction with the A.F.A. method, and states:—

"The chief difference between the British and American test specimens is the degree of

TABLE I.—*Sieve Analysis.*

Retained on screen. No.	Ottowa sand (round grain) Per cent.	Ohio crushed silica sand (angular grain) Per cent.
20	—	0·72
30	0·40	6·40
40	44·10	39·60
50	38·26	33·20
70	14·68	16·92
100	2·46	2·14
140	0·80	0·36
200	—	0·20
	100·70	99·54

compression. The British specimen is compressed to one or more standard densities before testing. The A.F.A. specimen is rammed by allowing a fixed amount of kinetic energy to be converted into compression work. However, it is impossible to convert more than a certain amount of this energy into compression. The remainder is dissipated in the form of heat

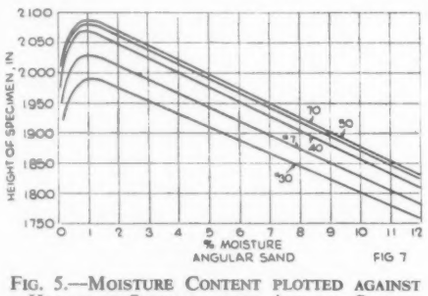

FIG. 5.—MOISTURE CONTENT PLOTTED AGAINST HEIGHT OF SPECIMEN WITH ANGULAR SAND.

in overcoming frictional resistance between the grains. The frictional resistance is different for different sands. Hence, the work done in compressing any sand will vary even though the energy input is constant. This has been pointed out earlier by Adams, 'Transactions,' American Foundrymen's Association, 1926.

"Buchanan, THE FOUNDRY TRADE JOURNAL, 1937, has pointed out that the degree of compression may be measured as the *dry weight* of the specimen, or the *dry apparent density*. He defines this term as the weight in grammes per millilitre of the dried test-piece. *Green apparent density* is defined by the same author as the weight in grammes per millilitre of the green test-piece. A third term, the true density, is defined as the ratio of weight of dry sand to the weight of the same volume of water at a given temperature. These terms will be used in this study."

Results Obtained

The authors found that the density of a rammed clay-free sand depended on the frictional resistance between the grains, *i.e.*, on the following factors:—(1) The size of the grains; (2) the shape of the grains; (3) the surface condition of grains; (4) distribution of the grains; and (5) water content of the sand.

They also found that the density of ramming increased with grain size, and explain this by the fact that large grains offer less frictional resistance through having fewer points of contact, a greater tendency toward the spherical shape and less tendency to the wedge effect common in angular sands.

Surface condition was also important, and this was demonstrated during their research by the fact that the duplicating of results was impossible on the same sand used repeatedly. Presumably this was due to the slight polishing effect in ramming in the A.F.A. test-piece rammer, and the change in ramming during the first two or three times it is rammed is said to be due to:—(1) Alteration of the condition of the grain by original coating; (2) a deposited coating from the water added; and (3) fines becoming detached from the grains.

Mixing is claimed to alter the condition of the surface, and the two sands used were washed in hydrofluoric and nitric acids and also in sodium hydroxide, and finally in water to remove fines and clean the grain surface to a stable condition. Angular grains were found to be more changeable during preliminary working and ramming than round grains.

This surface condition, in fact, was found to be of major importance in the study of clay-free sands, and it was found impossible to obtain reliable results on sand in which moisture had been increased for re-testing.

The surface condition changes as well as the moisture; this leads them to the conclusion that this behaviour of sands shows up the most important shortcoming of the A.F.A. method of test-piece preparation, namely, *the inability to duplicate specimen on one and the same sand.*

The authors also found that, mixing two-thirds 40-mesh and one-third 100-mesh Ottowa

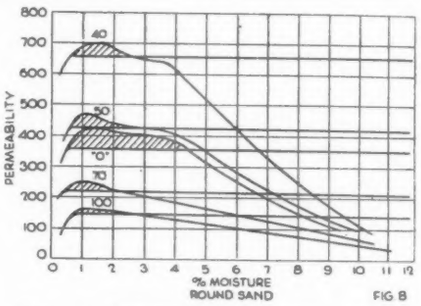

FIG. 6.—PERMEABILITY PLOTTED AGAINST MOISTURE CONTENT FOR ROUND SAND.

round grain sand, a higher density was obtained than in the natural unsieved sand set out in Table I, thereby verifying, at least, in washed clay-free sand, the fact that small grains can arrange themselves in the air spaces between larger grains, as pointed out by Sheehan.*

Effect of Moisture on Clay-free Sand

The effect of moisture on washed clay-free sand grains is explained by the authors in the following terms:—

"As the water content is increased, it tries to surround the individual grains with a water film. The film grows thicker and stronger, and increases the friction between grains until a critical film thickness is reached. Any increase in water content above that critical amount has no influence on friction. The critical amount of water is greater for a fine-grained sand because the surface area is greater.

"The dry apparent density or dry weight of the same sand is therefore constant and independent of water content above 2 per cent. moisture (provided there is no change in the surface condition of sand grains). The apparent density, on the other hand, increases as a hyperbolic function.

$$D_g = D_d + \frac{D_g M}{100}$$

Where D_g = green apparent density in grammes per cubic centimetre; D_d = dry apparent density in grammes per cubic centimetre, and M = moisture content in per cent. At moisture

* International Foundry Congress, London, 1939.

Fundamentals of Foundry Sands

contents from 2 to 12 per cent., this function may be represented by a straight line."

Calculating the Index of Ramming

Using the true densities, *i.e.*, round grained sand 2.65 and angular silica 2.64 and the dry density of the sand tests, the percentages of voids were calculated with change of moisture; above 2 per cent., the authors found the percentage of dry voids constant in the two sands and also in the sieve fractions separated therefrom. The authors have the following remarks to make on the Index of Ramming:—

"The ramming of the British specimen is based upon a term called index of ramming. This term may be expressed as follows:—

(*a*) Index of ramming =

$$\left(\frac{\text{dry apparent density}}{\text{true density}} \times 100\right) - 42.$$

(*b*) The term $\left(\frac{\text{dry apparent density}}{\text{true density}} \times 100\right)$

actually represents the percentage volume occupied by the grains or 100 minus per cent. dry voids. The expression (*a*) may then be written:

Index of ramming = 100 − dry voids − 42.

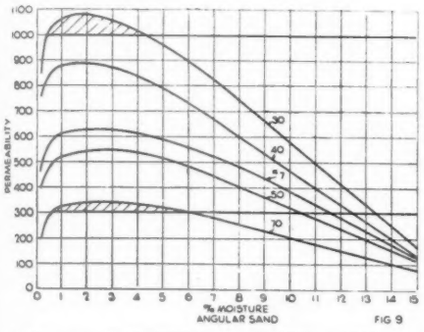

FIG. 7.—PERMEABILITY PLOTTED AGAINST MOISTURE CONTENT FOR ANGULAR SAND.

"The percentage of dry voids for all sands tested in the present investigation are constant between 1.5 to 12 per cent. moisture. Each sand, both according to size and to shape, has a different percentage of dry voids. Therefore, the A.F.A. method of ramming gives a constant index of ramming for clay-free sand within the above indicated moisture range. The individual index of ramming numbers of the various mesh sizes tested are given in Table II."

Flowability Tests

The flowability tests described seem to have been difficult to make with any degree of accuracy. The method used was that proposed by Dietert, namely, the further compaction of the sand with the fifth blow of the rammer, and this showed that more uniform and accurate results were obtained on round grains owing to their smoother surfaces.

Fig. 1.—The sloping curves show the relationship of moisture content and green apparent density of both round and angular grains. The dry apparent density was determined by subtracting the moisture from the weight of the green test-piece, and this relationship is expressed as the horizontal lines. Water added to clay-free sand will increase the frictional resistance of the grains. This means that the dry apparent density decreases and the intergranular space increases. Frictional resistance increases very rapidly at first, then slows down gradually until a point is reached where the dry apparent density remains constant (flat portion of the curve). That critical portion of the curve lies between 1 and 2 per cent. water addition, approaching the higher amount with finer grained sand. As the density increases the water begins to surround the individual grains with a film of water. The film grows thicker and stronger and increases the friction between grains until a critical film thickness is reached. Any increase above this critical amount has no influence on the friction.

TABLE II.—*Index of Ramming the Sand.*

Sand.	Angular sand.	Round sand.
100-mesh	—	100−43·0−42=15·0
70-mesh	100−50·2−42=7·8	100−42·0−42=16·0
50-mesh	100−49·6−42=8·4	100−41·4−42=16·6
Unsieved	100−49·3−42=8·7	100−41·7−42=16·3
40-mesh	100−49·0−42=9·0	100−40·8−42=17·2
30-mesh	100−47·5−42=9·5	—
½ 100-mesh + ½ 40-mesh ..	—	100−37·5−42=20·5

Note.—The A.F.A. specimen is therefore not duplicable on this basis.

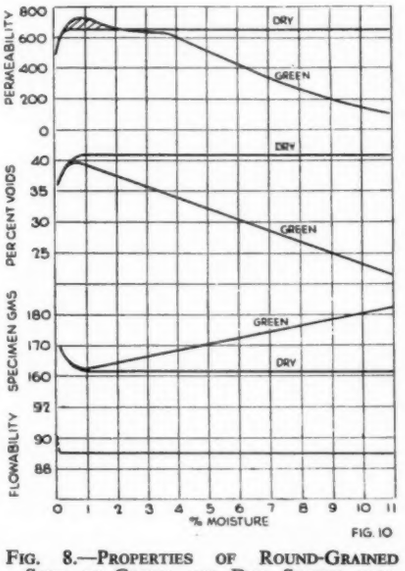

FIG. 8.—PROPERTIES OF ROUND-GRAINED SAND IN GREEN AND DRY STATES COMPARED.

Fig. 2 shows the relation between interstitial volume and moisture content. The dry voids are constant and independent of moisture above 2 per cent.

Fig. 3 shows that since the flowability, *i.e.*, change of height of specimen between the fourth and fifth blow, depends on the intergranular friction, and is constant above 2 per cent. moisture, it may be predicted that the flowability is constant and independent of moisture content above this percentage. The results obtained for round grains are more uniform than those obtained for angular sand values.

Figs. 4 and 5 show the relationship between moisture content and height of specimen of constant weight (170 grms. for the round grains and 140 grms. for the angular). The experimental values give a straight line for moisture above 2 per cent. This is to be expected, since the "dry apparent density" remains constant above this amount, and the increase in weight is due to additions of water at the expense of sand grains.

Fig. 6.—Each sand in this figure is represented by two curves, one showing the regular green permeability and the other showing the dry permeability.

Fig. 7 shows the green and dry permeability for 70- to 30-mesh sand respectively. The dry permeability results confirm conclusions from weight moisture experiments, namely, that the dry apparent density is constant above a certain water content.

In order to study the value of the properties in relation to one another, curves to 40-mesh round-grained sand are reproduced in Fig. 8. This summarises the effect of moisture on green and dry permeability, per cent. voids in green and dry specimen, specimen weight or density in the green and dry state, and flowability as measured by the method described in the Paper. At part of the moisture range, namely, 0.5 to 2 per cent., the curves show the green permeability to be greater than the dry permeability. This anomaly is explained by the authors in the following way:—

"The dry grains are said to have rough irregular surfaces, and the first additions of water go to fill up these irregularities, thus making the surfaces smoother. Smooth surfaces offer less resistance to the passage of air, and thus, so long as the addition helps to improve the smoothness of the grains, an improvement in permeability is obtained, but after the irregularities have been filled up, further addition of water will go to reduce the volume of the interstices, and thus reduce the permeability progressively."

Fig. 9 shows the authors' conception of the distribution of moisture on clay-free washed sands.

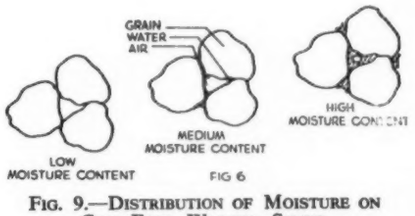

FIG. 9.—DISTRIBUTION OF MOISTURE ON CLAY-FREE WASHED SANDS.

It has been shown that the method of measuring flowability used by the authors may be misleading; however, whether this point of view is accepted or not does not matter here, since the authors are showing, for the most part, that flowability does not alter during most of the moisture range.

The authors then state:—"Buchanan, in THE FOUNDRY TRADE JOURNAL, 1938 and 1940, stated that the green permeability is independent of moisture content at constant index of ramming. That may be true for a short interval in sands of high clay content, but the present investigation shows that it is basically impossible."

The work referred to was, of course, carried out on a normal moulding sand taken from the foundry floor, and its origin was Scottish rock sand, which is, in fact, a sand of high clay content. It would seem that the effect of moisture on the useful range, *i.e.*, the range found in moulding sand fit for moulding purposes, is more important than the effect over an excessively wide range on sand which is not moulding sand at all; notwithstanding the fact that the experimental work on washed sand detailed in the article described so far is of considerable value in the study of the test methods under consideration.

Conclusions

A summary of the conclusions arrived at as a result of this investigation into the effect of moisture on the properties of clay-free sand using the A.F.A. method of preparation of the test-pieces is as follows:—

(1) Round grains are more flowable than angular grains.

(2) Round sand grains are more dense, when rammed, than angular sand grains.

(*Concluded on page* 412.)

Pattern Equipment for Quantity Production of Small and Medium Castings

DISCUSSION BY EAST MIDLANDS FOUNDRYMEN

MR. DUNLEAVY, who opened the discussion on the Paper* by Mr. F. G. Butters of the above title at a recent meeting of the East Midlands Branch of the Institute of British Foundrymen, first congratulated Mr. Butters on the excellent lay-out of his pattern equipment and moulding machines, and suggested that a problem which required serious attention was the necessity of the speedy removal of the moulds from the machine, if the moulding machine was to be used to anything approaching total capacity. This was a problem beyond the scope of the Paper, but he felt it was one which was interwoven with the present subject. Could Mr. Butters give a little information on mould output, labour employed and floor space required for a specific job?

MR. BUTTERS, in reply, said Mr. Dunleavy had gone beyond the scope of the Paper altogether. No attempt had been made to indicate methods for mould removal. Actually the moulders work probably a minimum of 8½ hrs. per day, and can produce in the region of 100 moulds, the length of row being 18 by six deep, totalling 108 moulds, which is a full day's work. The area of floor space allotted to each moulding machine is approximately 400 sq. ft.

The "Split Mould" Method

MR. HALLAMORE asked for a more detailed explanation of the "split mould" method for the production of plate patterns.

MR. BUTTERS, in reply, gave as an illustration the mould for an ordinary pulley. By placing a flat top on each of the two half-moulds it produced two half-patterns from one complete mould. Obviously, as the size and complexity of designs increased, this method became more complicated. Nevertheless, it was a really efficient and economical method of producing a pair of pattern plates from one mould.

MR. HOLLAND asked if it would not have been better to have cut out the expense of coreboxes in making these "split mould" patterns. He suggested two further tops ought to have been moulded off the two bottoms; that was by using four parts. Then the sectional thickness would have been more uniform, strengthening ribs being cut in the mould or formed by wood strips. Regarding dowelling, the method shown would be satisfactory in the case where moulding boxes were drilled to suit the pattern plate, but if the pattern plate must be made to suit existing boxes, some other method seemed necessary. When recently producing a twin cast plate, the method used was to cast a steel dowel in each corner of one plate with bushes to correspond in the other plate. From this location the pinholes to suit the existing box were jig drilled. These plates were cast in aluminium.

MR. BUTTERS, referring to Mr. Holland's remarks as to the making of the pattern so that it would lift its own ribs to eliminate cores, said his practice was not to make any special coreboxes for these patterns. They were cut by the pattern moulder to whatever shape he wished them to be. It was quite a workable proposition and he had not tackled the job in the way Mr. Holland suggested. He used the method explained in the Paper, and achieved reasonably good results. It was not a long job to carve the blocks out to suit the joints, and leave spaces in the cores to make supporting ribs. He thought his method was the quicker, and he could not see any improvement along the lines suggested.

His second point regarding two pairs of boxes being used would necessitate placing the pattern back in the top mould, a practice which should never be encouraged, as there was always the danger of damaging the mould impression. The method to ensure perfect matching of the two half-patterns, namely, by using four doubly countersunk discs, was very similar to his own method, with one important exception; this was, that countersunk discs were much cheaper to produce than steel dowels and bushes.

Metal Patterns

MR. PINCHIN said that Mr. Butters had outlined the various materials for the production of pattern equipment. For the lighter patterns he (the speaker) used non-ferrous metals, brass or aluminium, and not cast iron. He considered that cast iron would probably be a more satisfactory material, because, in the event of accidental rough usage, the non-ferrous patterns might distort. Damage to cast iron would most likely cause breakage, which is immediately noticed, but with a ductile material slight distortion might not be noticed before a dozen or more moulds had been produced, which in quantity production would cause a considerable amount of waste. Regarding thin section patterns, and the resultant chilling at the extreme edges, he thought anyone making this type of casting in cast iron would have available a suitable mixture which would eliminate this trouble.

MR. BUTTERS said the use of brass for very small patterns not only eliminated the chilling of very fine edges, but it also allowed the spray type of patterns to be built up by soldering. In the case of aluminium, there was a distinct advantage when the fatigue factor was considered, especially at the present time, where female labour was employed.

Corrosion of Metal Patterns

MR. J. R. ROXBURGH referred initially to the question of the double-sided pattern plate. It was rather a difficult matter to ensure that such a pattern plate was perfectly straight. When Mr. Butters referred to supporting a double-sided pattern plate, which was black, on the machined surface of an adaptor piece, it must of necessity follow that the pattern plate should be straight and flat. He wondered if Mr. Butters would indicate what precautions he took in order to ensure that his double-sided pattern plate was straight.

With regard to the use of proprietary pattern compounds for making oddsides for machine moulding, Mr. Butters did not specify the particular metal used for the patterns anchored in such compounds. He thought the lecturer should have issued a warning here in respect to this as it was well known that some compounds corrode certain metals.

In the use of four pin-lift machines, of the type described by Mr. Butters, it was obvious that it was more difficult to push the mould up off the patterns than it was to withdraw the patterns from the mould. In consequence of this he asked what experience Mr. Butters had had, as regards good and bad "lifts," and also with reference to the finish of his patterns, their accuracy and the amount of taper he usually allowed.

Avoiding Distorted Patterns

In reply to Mr. Roxburgh's comments, MR. BUTTERS said that he did not experience much trouble in keeping the pattern plates straight. He did, however, have cause to reject a plate about a fortnight ago, which was cambered $\frac{3}{16}$ in. The size of the plate was 12 in. by 18 in. and the patterns were of very simple design. After careful investigation it was noticed that the pattern plate had been run with a spray runner on each of the long sides, and a riser on each end. It was decided that the plate be made again in the same manner with the exception of the risers, which were omitted. This casting was perfectly straight and sound, which proved fairly conclusively that the camber or bend in the first casting was caused by the risers restricting the contraction of the plate.

Regarding the plates that have slight irregularities, such as $\frac{1}{32}$ in. of twist or camber, they were studded in the corner affected, so that the plate rested firmly on the machined frame. He had very few studded pattern plates. In some instances, when plating patterns of very heavy sections, it was necessary to bare the plate where the heavy sections occurred, in order to equalise the rate of cooling, otherwise there was a serious danger of internal stress or, worse still, the plate may fracture on cooling.

On the question of metals used in conjunction with compounds, his experience was rather limited, as the only compounds he had used were plaster of paris and cement with cast-iron patterns embedded in them. These patterns stand up to normal foundry service conditions very well, the corrosion of the patterns being negligible. With reference to pin-lift machines, he quite agreed it was more difficult to push moulds off than to draw the pattern from the mould. Nevertheless, consistently good results could be obtained provided that the machines were kept in good order. It was, of course, necessary to have the moulding boxes machined, and the finish must of necessity be good. The taper allowance was generally about $\frac{1}{8}$ in. to 1 ft.

Wood and Aluminium Composite Patterns

MR. J. E. COOKE said that Mr. Butters had supplied substantial information regarding metal patterns made in cast iron, but points of advantage possessed by brass patterns were the ability to build up sheet or extruded sections, and the very fine finish obtainable. The ease with which repair could be carried out often offsets their greater liability to damage.

Aluminium patterns were often regarded as unsatisfactory on account of their tendency to corrosion, but over very long periods dimensional loss was extremely slight where brushing off and varnishing the plant was regularly practised. Indeed maintenance and care in handling all metal patterns amply repayed extra trouble necessitated.

In these days it is a national duty to economise on the use of all non-ferrous metals, and this Paper has suggested several methods that can be used to advantage. A successful method of reducing the metal section of cast aluminium patterns was to place a wooden block in the mould and cast a mere shell of aluminium around it. The surface of the timber is only slightly charred during the casting operation, and the timber interior afforded a very convenient means of attaching the pattern to the pattern plate by means of wood screws. Where metal patterns were embedded in any of the "stone compounds" trouble may be caused through either contraction, sweating, expansion, or corrosion through chemical reaction. Could Mr. Butters offer information regarding any such compound which was free from these disadvantages?

MR. BUTTERS, in reply, referred to the corrosion of aluminium patterns, and agreed that with periodical varnishing such patterns had an extremely long service life. Regarding the use

(*Concluded on page* 410.)

* See "Foundry Trade Journal" for December 18, 1941.

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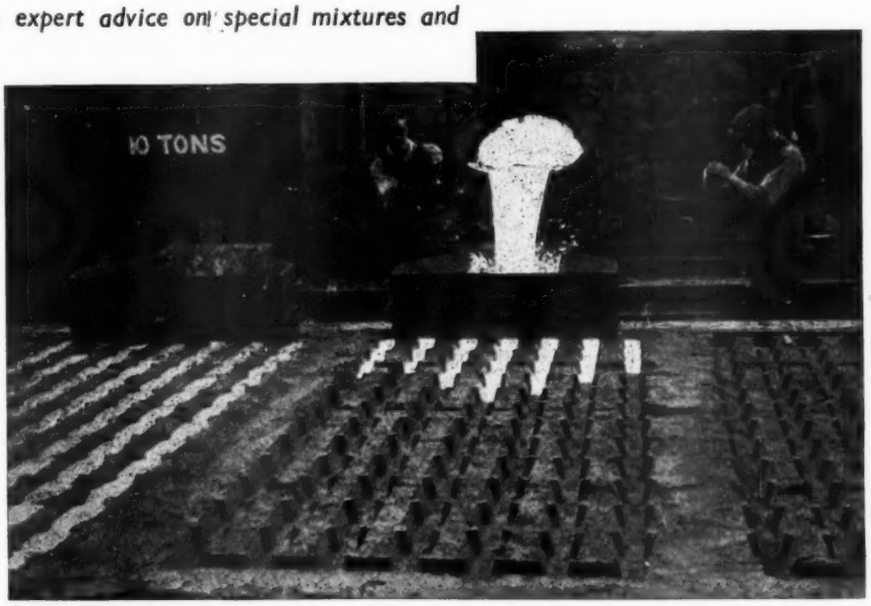


THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

The Teesside Foundry Industry

Mr. O. WILSON'S PRESIDENTIAL ADDRESS

About 60 members and their ladies attended a social gathering held at Spark's Café, Middlesbrough, to inaugurate the 1941-42 session of the Middlesbrough Branch of the Institute of British Foundrymen. Mr. D. R. Kinnel presided at the opening stages and inducted Mr. Oliver Wilson into the chair. Mr. Wilson then delivered his Presidential Address, in the course of which he said:—

Mr. Kinnel and Gentlemen.—It seems a long time ago, but actually only eleven years, since I was present during a period of hectic mental strain while my father composed his Presidential Address for the 1930 Convention. I wondered at the time if I would have a similar job to do in the future and now it has come. Nevertheless, let me assure you that I am deeply conscious of the honour you have bestowed on me by making me your Branch-President for this session, and I hope that I will uphold the office in as meritorious a way as my predecessors.

We of this Branch have been doubly unlucky by our having been prevented from holding two events to which we had all looked forward, entirely owing to the misguided zeal of Adolf. The first was the 1940 Annual Convention of the I.B.F. that should have been held here to celebrate the election of Major Miles to the presidency, and our own annual dance and social which has always been such a success. That Major and Mrs. Miles had no convention is most unfortunate and we are very sorry that this event had to be cancelled. I do most earnestly hope, however, that we, as a Branch, will have an early opportunity after the war of inviting the Institute here for their convention. All the same we are particularly fortunate in having a man like Major Miles not only as a member of this Branch but as President of the Institute for this year, and I assure you that convention or no convention his Presidential Address at Manchester this year was outstanding in addresses of this kind—he has left nothing for anyone else to say.

Branch Matters

Running a Branch efficiently under wartime conditions is not at all easy. Unforeseen things tend to happen and to plan far ahead is most difficult, as you all know, and this applies especially where speakers from a distance are concerned. Therefore all praise is due to Mr. Smithson, who jumped into a very difficult breach when Mr. Kirk was called away to other duties. Mr. Smithson puts much time and thought into his work, and the Branch affairs continue to prosper. The efforts of both President and secretary are just a waste of time without the active co-operation of all members. As I have already said, speakers sometimes have long journeys to make to get here and at present this is not fun, therefore the least we can do is to turn up at as many meetings as we can and get every scrap of information. No doubt Saturday afternoons upset the gardeners and football enthusiasts, but whilst existing black-out conditions prevail your Council feels it is the most convenient, although it has its drawbacks. Remember that it is a rotten job speaking to rows of empty chairs, so do your best and fill them.

The Future

Ultimately this war will end, and the success of the post-war world will depend on the effort, thought and planning that is done now to construct a better state of affairs than we have had before. Our world will be drastically altered without doubt, and before anything can be done a start will have to be made in reconstructing Britain, a huge task, much of the weight of which will fall on the foundries. But supposing the requirements of the new builders are not just the same as we have had in the past? Whatever is wanted the foundries will supply in due course. But do not forget that the ironfoundry is not in the same position as it was fifty years ago (some are!); new ideas have been coming into the world and taking tangible form; we have a whole world of plastics opening up before use, some of which very seriously compete with our own trade. If left as it is, the ironfoundry might gently fall back into disuse as more and more non-ferrous alloys are used for the everyday articles of mankind. This must not happen and it need not if the foundry keeps up to date and is ready to adopt and adapt. On Teesside, for instance, we have not been remarkable for new methods. In the steel-foundries I know much is being done which is quite new to this district, but the ironfoundries have not attempted to copy or improve on other parts of the country. Surely, it does not mean that because heavy castings are associated with this district we cannot tackle anything? Local moulders are just as good as in any other part of the country. To some extent the trouble is age-old prejudices and is quite parallel to the fact that in some parts of the country they make Banbury cakes and in others Yorkshire pudding, and neither tells the other how it is done. Let us therefore encourage the learning of other people's recipes and infuse some new foundry work into this district.

I feel rather strongly that the industry as a whole is in grave danger of being left far down the field and becoming a back number; the I.B.F. is here to prevent it and is doing fine work, but you know it would be a poor business if a comment in Bernard Shaw's "Apple Cart" were to come true. He made the Colonial Secretary remark:—"Take Gateshead and Middlesbrough alone. Do you know that there has not been a single day's unemployment there for five years past, and that their total daily output of chocolate creams is up to 20,000?" It may be some consolation to you that in a previous speech another character remarks that Birmingham was the centre of the Christmas cracker industry of the world.

This will not happen, but what will? Surely it will well repay us to give the whole question our most earnest thought and discussion. There *is* room for improvement, and the iron-founders must be there or they may get left behind—the iron age might become non-ferrous in the brave New World to come, so let us get down to the job of looking ahead and planning.

Something toward this of which we should be proud is the work done and being done by both students and staff of the Foundry Technology courses at the Constantine College. Since 1936 the City and Guilds of London Institute has awarded to its students three silver and five bronze medals, which merit our heartiest congratulations. They are doing the industry an excellent service there, and we should do our best to encourage likely lads to take the course, because on them may fall the job of rejuvenating the industry—who knows?

On the proposition of MR. KINNEL, seconded by MR. F. SWIFT, Mr. Wilson was accorded a very hearty vote of thanks.

COLOMBIA WAS THE CHIEF SOURCE of iron ore imports to the United States in June, accounting for 164,400 tons out of a total of 224,928 tons, according to the U.S. Department of Commerce. Canada was second largest source with 34,611 tons.

British Coal Utilisation Research Association

Sir Evan Williams, Bt., in his presidential address to the members of the British Coal Utilisation Research Association, noted with satisfaction that special grants from industrial groups for the acceleration of programmes to which they attached importance had more than quadrupled. Some of the problems which had been entrusted to the Association, said Sir Evan Williams, were of vital importance in wartime. Research in 1940 was largely devoted to three main investigations. The first was the development of a portable gas producer to replace petrol on the road. The second was to find a suitable producer-gas fuel which could be produced in large quantities from coals available throughout the country. The third task was to endeavour to improve the availability of large boilers by reducing the tendency to blockage in boiler and superheater tubes by deposits carried over from the fuel bed. In all these investigations they laid in 1940 the foundations of success. Already very satisfactory results had been obtained. It was well known that the principal cause of involuntary outage of large boilers in all industrial countries was the fouling of external heating surfaces by adhesive deposits. They had shown that it was possible, by operating adjustments, to reduce deposits so considerably that the life of boilers could be increased three- or four-fold. Tests made over a period of months in one of the principal Midland power stations confirmed their findings. This work was being actively pursued with the help of facilities made available to them by Babcock & Wilcox, Limited, on their experimental high-pressure boiler at Renfrew, the only one of its kind in this country. Apart from these main lines of investigation, they had undertaken a number of researches on behalf of industrial coal users and Government departments.

E.P.T. and Surplus Funds

In the House of Commons recently, Sir Irving Albery asked the Chancellor of the Exchequer which of the following financial arrangements of an ordinary trading company were treated as cash and which as investments for the purposes of estimating E.P.T.:—Money on deposit at call, money on deposit at short notice, and Treasury bills. Sir Kingsley Wood replied that the capital to be taken into account for the purposes of E.P.T. was that capital which was employed in the business. In the case of the ordinary trading concern investments in Government securities, including holdings of Treasury bills, could not be regarded as capital so employed. The extent to which cash, including moneys held at bank on call or at short notice, fell to be regarded as capital employed in a business depended upon the circumstances of the individual case, and if the cash held exceeded what was required for the purposes of the business, the excess could not be treated as capital employed. Capital employed in a business ranked for allowance at 8 or 10 per cent. in the computation of a concern's liability to Excess Profits Tax and it was important that it should be clearly understood that this high return could not be allowed on idle funds which were really not in use in the business, but were available for investment in the Government securities now on issue.

Pattern Equipment for Quantity Production of Small and Medium Castings

(*Concluded from page* 408.)

of "stone compounds," he was afraid that his limited knowledge of such compounds for pattern plates would not be very helpful, as he had eliminated all compounds for pattern mounting, and used only pattern plates of all-metal construction.

Vote of Thanks

On a proposal, made by MR. ROXBURGH, seconded by MR. DUNLEAVY, a hearty vote of thanks was accorded to Mr. Butters, who in reply offered his help to those interested in mould handling, which subject was obviously beyond the scope of his Paper.

FOR ACTIVE SERVICE

AVAILABLE FOR PROMPT DELIVERY

ROWLAND

FOUNDRY TYPE ABRASIVE WHEEL

CUTTING-OFF MACHINE

"Rowland" grinders are playing their part in the war effort and are extensively used in armament factories. The abrasive wheel type cutting-off machine shown here, for instance is installed in foundries all over the country. It is designed and built for speedy cutting off of gits and risers up to 3in. dia. The wheel head swings to any angle: a useful feature when dealing with castings too large for the table.

Three alternative methods of operation are available: (1) lock head and pull head down by hand, (2) lock both head and wheel and push work through, (3) swing head clear of table, lock both head and wheel and cut off small work fed by hand.

Duplex tables available to simplify the holding of awkward-shaped castings.

F. E. ROWLAND & CO. LTD., CLIMAX WORKS, REDDISH, STOCKPORT.

United States Aluminium Industry

To meet the astronomical demands of the American defence programme, the aluminium industry is being expanded at a rate unprecedented in American history. Plans made up to the present provide for an expansion of more than 350 per cent. in two years. The goal of the OPM is 750,000 short tons of aluminium a year. Currently production is at the rate of about 300,000 tons annually. New plants, on which construction was begun in the early phases of the defence programme, will shortly come into production. It is expected that the 500,000 ton output will be reached some time in 1942, according to the timetable. Increases after that point will be slower, according to the programme in force before America's entry into the war. The situation has now been transformed, and a much expanded programme is likely to be adopted in the very near future.

In contrast with the generally rising trend shown in other commodity prices, aluminium has declined from 20 c. a lb. in the pre-war era to 15 c. at present. What prices will be after the war when the huge productive capacity now in building is freed of war work and is again available for consumer goods is a matter still shrouded in mystery. The president of Reynolds Metal Company, a newcomer in the aluminium-production field, has said that aluminium can be made as cheap as 10 c. a lb. In any event it is apparent that considerable reorganisation of the channels of consumption of the various metals is due when competitive conditions return, comments "Iron Age."

Al Demand for Aircraft

The cause of the aluminium expansion is due to the development of the airplane as a weapon. Close to 90 per cent. of the weight of a military plane is aluminium. This in turn is roughly broken down into 45 per cent. sheets, 17 per cent. forgings, 15 per cent. sand castings, 13 per cent. extruded products, 3 per cent. tubing, 3 per cent. rods and bars, 2 per cent. rivets, and 2 per cent. miscellaneous forms and paints.

The exact demands of the aircraft industry for aluminium varies as the production emphasis varies from model to model. A training plane uses comparatively little aluminium, but the heavy four-engined bomber takes close to 30,000 lbs. of the light metal. In contrast to this figure, a Navy dive-bomber requires about 10,000 lbs., a pursuit plane 5,000 lbs., and a medium two-engined bomber 18,000 lbs.

There are concentrations of aluminium plants in two areas, one in the Bonneville Dam district in the North-West and the other in the TVA basin in the South. These concentrations are chiefly a reflection of the large quantities of electric energy required to smelt aluminium. Actually Alcoa is the largest industrial user of TVA and Bonneville hydroelectric power. Coupled with the increase in alumina and smelting plants, has been an equally important but less spectacular expansion in aluminium fabricating facilities.

Expansion in Fabricating Capacity

A suggestion of the magnitude of this fabricating expansion is given in the figures covering such extension to capacity of Alcoa. Comparing facilities which became available in December of this year with capacities of December, 1939, the expansion has been roughly of the following order: forging capacity, 163 per cent.; sheet rolling, 56 per cent.; tubing, 157 per cent.; rolled wire, rod, etc., 190 per cent.; extrusion, 138 per cent., and sand castings, 218 per cent.

Somewhat overshadowed by the large public funds now being put into new aluminium facilities is the fact that the Aluminium Company of America last year began an expansion of facilities costing about $200,000,000. A large part of the aluminium industry is mortgaged or owned outright by the American Government. In the case of Alcoa alone, the U.S. Government will own close to 45 per cent. of the company's expected capacity in mid-1942. At that time the company expects to be producing about 550,000 tons of aluminium, of which 360,000 tons will be from plants wholly owned by Alcoa and 170,000 tons from Government-owned plants.

Another phase of the Government participation in the aluminium industry is the new companies that are being encouraged to enter the field, such as Union Carbide & Carbon Company, Reynolds Metals Company, Bohn Aluminium & Brass Company and the Olin Corporation. The larger alumina and smelting plants in operation currently are the Lister Hill plant of Reynolds Metals Company, with a capacity of 20,000 tons a year, and the five Alcoa units—Alcoa, Tenn. (82,300 tons); Massena, N.Y. (71,000 tons); Badin, N.C. (29,440 tons); Niagara Falls, N.Y. (18,590 tons), and Vancouver, Wash. (5,000 tons). In addition, the following plants are under construction: Reynolds Metals Company, Lister Hill, Ala. (50,000 tons); Union Carbon & Carbide Company, Spokane, Wash. (30,000 tons); Bohn Aluminium & Brass Company, Los Angeles (35,000 tons); Olin Corporation, Tacoma, Wash. (15,000 tons). In the latter plant, the possibility of utilising the alumite process is being explored.

Some Fundamental Aspects of Foundry Sands

(*Concluded from page* 407.)

(3) Angular grains have greater intergranular space when rammed.

(4) Angular grains have higher permeability than round grains.

(5) Between the range of 2 to 12 per cent. water variation has no effect on (*a*) intergranular void volume, (*b*) dry permeability, and (*c*) flowability.

(6) In a relatively low moisture range (about 0.5 to 2.5 per cent. for round and 0.5 to 4 per cent. for angular grains), the green permeability exceeds the dry permeability values.

The greatest shortcoming and criticism of the A.F.A. method of ramming a standard specimen is the inability continually to duplicate results obtained when using a sand for repeated tests. This change has been attributed to the change of shape and surface condition of the sand grains.

It might be pointed out here that no clay-bonded sand sample can be retested without showing variation of results, because the act of ramming is a form of milling and has an effect on the distribution of clay bond, and unless the sand is aerated carefully after testing the effect of the first ramming will not be eliminated from the second ramming in making the test-piece.

When testing, the sand used for making the green specimens should be discarded immediately, and the need for this is really no greater in the case of the A.F.A. method than in any other. In fact, the method of preparing a sample should be standardised and carefully adhered to.

The practice always advised by the commentator is to take a sample in an air-tight tin 6 in. dia. and 9 in. deep. Before testing, this sample is turned out and put through a ¼-in. mesh sieve, after which it is put into a mixing drum. From this the quantities are drawn for making the test-pieces and the tests always discarded. Where repetition is required the sample volume must be increased accordingly to allow new sand being used each time.

Chrome Ore and Concentrates

PRICES FOR 1942

Until further notice, the Ministry of Supply, Chrome Ore, Magnesite and Wolfram Control, is prepared to accept and execute orders from consumers of chrome ore and concentrates at the undernoted prices:—

	Per ton. £	s.	d.
Baluchistan metallurgical chrome ...	11	19	0
Rhodesian metallurgical lumpy, 1st grade	11	15	0
Rhodesian metallurgical washed friable	11	15	0
Cyprus metallurgical concentrates ...	11	15	0
Rhodesian metallurgical lumpy, 2nd grade	11	7	0
Transvaal chemical concentrates ...	11	7	0
Rhodesian chemical washed friable	11	7	0
Baluchistan chemical chrome ...	11	7	0
Rhodesian chemical Dyke chrome	10	19	0
Transvaal refractory chrome, 1st grade	9	19	0
Rhodesian refractory Imperial grade	9	12	0
Greek refractory chrome	9	5	0
Transvaal refractory chrome, 2nd grade	9	5	0

These prices are all f.o.r. consumers' works. Orders should be addressed to the Controller of Chrome Ore, Magnesite and Wolfram, Broadway Court, Westminster, S.W.1, and should contain full delivery instructions, giving the name of siding, if any, or nearest railway station.

Consumers may order up to six months' requirements at one time, but the Control reserves the right to make part deliveries against each order when full delivery is either not possible or impracticable. Licences to purchase direct from the Control will not be required, but no resale is permitted without the written approval of the Controller.

New Man-Power Plan

DEFERMENT SYSTEM DETAILS

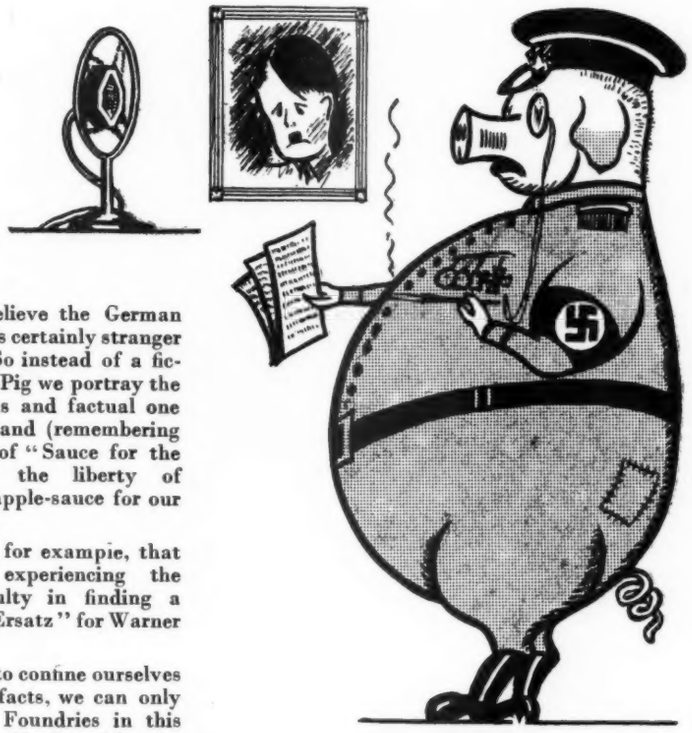
A revised edition of the Schedule of Reserved Occupations was issued last week. It provides for the new system of individual deferment to replace the system of block reservation. No amendment to the ages of reservation is involved in the new schedule apart from the changes which have been made and announced from time to time.

The new ages of reservation will be raised by one year on the first of each month. Thus, if the age of reservation for an occupation shown in the Schedule is 25, it will become 26 on January 1, 1942, 27 on February 1, and so on. A notification will be sent to each man affected by this arrangement stating the date on which he will cease to be reserved and requesting him to inform his employer. Men below the ages of reservation for their occupation, including men who cease to be reserved as a result of the raising of ages of reservation each month, will, where necessary, be retained in industry by means of individual deferment of calling up.

Forms of application for deferment (Forms N.S.300), and a leaflet (N.L.8) explaining the method of making application may be obtained at any local office of the Ministry of Labour and National Service. Application forms, after completion, should be forwarded to the office of the Ministry of Labour and National Service shown on the man's certificate of registration (N.S.2). Where a man ceases to be reserved under the arrangement for the progressive raising of ages of reservation, any application by his employer for the deferment of his calling up must be made at least 15 days before the date on which he ceases to be reserved. If the employer does not make such an application, an opportunity will be given to the man to make an application for deferment when he is called for medical examination.

AMERICAN MANUFACTURERS were asked to eliminate steel cover lids from domestic cooking ranges by December 15, 1941. These tops, usually finished in baked enamel, are used on many stoves to cover the cooking surface when the stove is not in use. By discontinuing these covers, manufacturers will reduce production costs and at the same time make available for more essential uses about 2,500 tons of steel a year.

"Jairmany Calling ...."



If we are to believe the German wireless, truth is certainly stranger than fiction. So instead of a fictitious Warner Pig we portray the *really* humorous and factual one from Bremen, and (remembering the old adage of "Sauce for the Goose") take the liberty of borrowing his apple-sauce for our impropaganda.

We might say, for exampie, that Germany is experiencing the greatest difficulty in finding a satisfactory "Ersatz" for Warner Pig Iron.

But, if we are to confine ourselves to established facts, we can only tell you that Foundries in this country are specifically calling for Warner Pig Iron, and that, knowing the destination of many of their products, we are supplying it to our usual standard, but with more than our usual satisfaction.

For

Warner's

Special Pig Irons

WARNER AND CO. LTD., CARGO FLEET, MIDDLESBROUGH

The Week's News in Brief

Trade Talk

PERSONAL OR DOMESTIC COOKING, heating and other appliances and apparatus are included in a new list of goods on which price control has been imposed.

THE BOARD OF TRADE Control of Factory and Storage Premises, since it came into operation last May, has allocated nearly 50 million square feet of floor space—about 4,000 premises—one-third being for production and two-thirds for storage.

THE FORMATION of a company with £200,000 capital to re-open Rushbrooke Docks, Cobh, as a ship-repairing base, is reported. Following the granting of a pig-iron quota to Eire, it is hoped locally that the steel plant at Haulbowline, Cork Harbour, which was forced to close down a year ago, may be restarted.

THE DIRECTORS of the Partington Steel & Iron Company, Limited, announce in a circular to shareholders that they have recently made arrangements for the sale of a large block of the company's holding of "A" ordinary shares in the Lancashire Steel Corporation, Limited, which will enable them to repay the outstanding £891,751 6 per cent. income debentures and the bank loan, now standing at £80,000. It will now be possible to put the company into liquidation and to distribute the remaining assets.

ESTIMATES OF NEW ENGLAND'S foundry capacity place it around 225,000 tons, as against some 450,000 tons 20 years ago. This decline reflects the change in the type of production with greater emphasis on steel, as well as the complete disappearance of many large foundries. Within five years two large stove foundries in Taunton, Mass., have been eliminated as important iron consumers, while the biggest New England consumer of 20 years ago takes extremely little to-day.

IT IS EXPECTED that compulsory powers will be taken to enable the Ministry of Works and Buildings, which collects scrap iron and steel on behalf of the Ministry of Supply, to schedule unnecessary railings for removal. The same Ministry will also be empowered to take other kinds of scrap, such as obsolete plant and machinery, which are the subject of a national survey now in progress. This survey, hitherto undertaken by local authorities, will be completed by the Ministry of Works and Buildings. The import of scrap steel and iron has virtually ceased. Except for a few cargoes under old contracts, no others are expected, at any rate for some time. A staff of men and women is being recruited who will tour the country to seek untapped reserves of steel and iron, it is announced.

THE NATIONAL ARBITRATION TRIBUNAL has awarded a 5s. a week increase in wages to male workers in the shipbuilding and engineering industries, beginning last week. The increase is for members of trade unions affiliated to the Confederation of Shipbuilding and Engineering Unions, of those unions represented by the Engineering Joint Trades Movement, and members of the Amalgamated Engineering Union and of the National Union of Foundry Workers employed by members of the constituent associations of the Shipbuilding Employers' Federation and the Engineering and Allied Employers' National Federation. The men's claim was for "a substantial increase in wages." The tribunal, under the chairmanship of Mr. Justice Simonds, in arriving at its decision, states that it took into consideration, among other things, a comparison between the wage standards of these and other industries, both at the present time and in the period since the outbreak of war and over a period of years preceding the war. The tribunal also took into account that changes in the amount of the so-called national bonus, which has existed since 1917, have been the agreed normal method of increasing or decreasing wage rates in the industries, and that the national bonus therefore stands on a different footing from bonuses in industry which have only come into being since the war and are related solely to changes arising out of the war.

SPEAKING at the annual meeting of Birmid Industries, Limited, Mr. Percy Pritchard (deputy chairman and joint managing director) contended that the level of taxation on industry to-day was such that, combined with the inadequate wear and tear allowances granted by the Inland Revenue, it was impossible for many firms to provide funds to meet really essential expenditure on the plant and equipment necessary for the purpose of increasing production. He had information relating to companies which, although making large trading profits, were left with nothing in the form of net profit after they had made the necessary provision for taxation, disallowances for depreciation, War Damage Insurance, and A.R.P. expenditure. Such firms could not even provide dividends, and most certainly could not find money from income wherewith to expand their productive capacity. The result in such cases was that either the extra production was lost to the nation, or man-power was wastefully employed doing work which otherwise could and should be done mechanically. A further, and possibly even more serious, hindrance to the national effort, said Mr. Pritchard, was the effect of the dead man's hand on production caused by over-centralisation of Government control departments. When it came to consideration of projects or course of action to be decided no latitude or discretion was given to the man on the spot to say "yes." Approval could only come from higher up, and not infrequently had to be given through the medium of several committees. On the other hand, when it was a matter of informing industry what they were not allowed to do there seemed to be hordes of officials who were endowed with plenary powers in this respect. For every official who was willing and able to say "yes" to any project there appeared to be dozens who were prepared to say "no." The sense of frustration that this atmosphere aroused had to be experienced to be appreciated.

Personal

MR. LESLIE F. WRIGHT has been re-elected chairman of the Cleveland Institution of Engineers.

CAPT. Q. H. PATERSON and MR. HENRY LITHGOW have been elected directors of William Beardmore & Company, Limited, the latter in place of Mr. H. A. Reincke.

SIR JAMES FORTESCUE FLANNERY, Bt., chairman of Flannery, Baggallay & Johnson, Limited, consulting engineers, and of Callender's Cable & Construction Company, Limited, celebrated his 90th birthday on Tuesday of last week.

MR. WILLIAM BROWN PICKERING, director and commercial manager of Hadfields, Limited, East Hecla Works, Sheffield, has completed 50 years with the company and at a gathering on Saturday last, December 13, he received a presentation from the directors to mark the occasion. Mr. Pickering is chairman of the General Steel Castings Association and of the Steel Castings Manufacturers' Association, and is also chairman of the Dredger Spares Export Group, a member of the Grand Council of the Federation of British Industries, and chairman of the Sheffield and District Branch of the Federation. Educated at King Edward VII Grammar School, Bishop Auckland, Mr. Pickering received his early business training from his father, the late Mr. Thomas Pickering, who was divisional superintendent at Newcastle-upon-Tyne for the North-Eastern Railway. When he subsequently joined the staff of Hadfields Steel Foundry Company, Limited—now Hadfields, Limited—he was given control of that firm's traffic arrangements, transferring later to their commercial department. He was selected to go to South Africa to open and organise the company's own office in the Union. In 1912 he was appointed commercial manager of Hadfields, Limited, and in 1914 he became an official director. On behalf of his firm Mr. Pickering has done much Continental and overseas travelling.

Wills

NEEDHAM, J. W., of Manchester, a director of Crompton, Parkinson, Limited £7,627

NORTON, PHILIP ARTHUR, of the Norton Harty Engineering Company, Great Bridges £5,457

LEE, A. S., of Sheffield, a director of Arthur Lee & Sons, Limited, steel manufacturers ... £73,387

RICHARDSON, E. H. A., managing director of Associated Electric Vehicle Manufacturers, Limited £4,501

JACKSON, F. H., joint managing director of the Coventry Radiator & Presswork Company, Limited £77,973

WESTCOTT, V. R., managing director of Harper & Moores Firebrick Company, Limited, Stourbridge £7,866

GREENWAY, J. L., founder of Greenway Bros., Limited, sheet rollers and galvanisers, Bilston and Widnes £578,497

Obituary

MR. GEORGE RAWLINGS, managing director of the Neville Foundry Company, Limited, Rotherham, died recently.

THE STEEL FOUNDRY INDUSTRY will indeed be grieved to learn of the death of Mr. J. Deschamps, which took place on December 17 at a nursing home in Hitchin. Most of his career has been spent at the works of Kryn & Lahy, Limited, of Letchworth, where he, more than anyone else, contributed to its growth into one of the foremost steel foundries in the country. Deschamps had very definite, yet strictly orthodox, views on metallurgy, which he was able to correlate with practice and commerce. His pioneer work on the conduct of the baby Bessemer has never been adequately recognised. He was a pioneer in developing the high steel charge in the cupola; soda ash desulphurisation; the use of the Poumay system of cupola control; the practical application of Dr. Herty's theories for the production of clean steel, and finally he led a campaign for increased stringency in the specificational requirements of steel castings. Another feature to which he gave much thought and achieved real success was the redesigning of headers so as to reduce their mass whilst still conserving their effectiveness. He was not merely an enthusiast in matters metallurgical, but his personality was such that he communicated this enthusiasm to all with whom he contacted. He was a keen supporter of the Institute of British Foundrymen, which he joined in 1937, and subsequently served on the London Branch Council and on the Steel Castings Sub-Committee. The Proceedings contain several reports of lectures which he gave, but they scarcely do him justice, as his avowed object was to create a discussion so that information could be given on the phases which appealed most to his audience. Deschamps possessed a character that endeared him to all foundrymen because his readiness to help people with their difficulties was generally recognised and appreciated. To his family and co-directors we extend our sincere sympathies.

Reports and Dividends

(Figures in brackets refer to the previous financial year.)

Belliss & Morcom—Interim dividend of 4% (2½%).

Jonas Woodhead & Sons—Dividend of 10% (same).

Universal Grinding Wheel—Dividend of 10%, tax free (same).

Electric Furnace Company—Interim dividend of 3¾% (3½%).

Wellworthy Piston Rings—Final dividend of 10%, making 15% (same).

Marles Steering Company—Profit to June 30 last, £5,651; dividend of 10% (same).

Mann, Egerton & Company—Net profit for the year ended September 30, after taxation, £24,821 (£23,252); dividend of 10% (same) on the ordinary shares.

Cannon Iron Foundries—Dividend on the 5½% redeemable cumulative preference shares of 5½% per annum, less tax, for the two years ending December 31, 1941.

B. & F. Carter—Trading profit to July 31, £15,873 (£16,018); depreciation, £3,751 (£2,594); income tax and E.P.T., £10,200 (£4,929); dividend of 10% (same); forward, £7,334 (£8,763).

Marshall Sons & Company (Successors)—Profit for the year ended September 30, £277,893 (£282,414); income tax and E.P.T., £215,585; depreciation, £7,946; interim dividend of 3½%, £9,375; final dividend of 10%, making 13½% (same), £25,000; to general reserve, £20,000; forward, £66,728 (£66,741).

Contracts Open

Birmingham—Six miles of 33-in. dia. bitumen-lined and sheathed steel main, for the South Staffordshire Waterworks Company. Mr. Fred. J. Dixon, engineer-in-chief, 50, Sheepcote Street, Birmingham, 15. (Fee £2 2s., returnable.)

Salisbury (Rhodesia), January 19.—Supply and erection of piping equipment, for the City Council. Merz & McLellan, consulting engineers, 32, Victoria Street, London, S.W.1. (Fee £5 5s., returnable.)

Acknowledgments to Manganese Bronze and Brass Co. Ltd., Woodall-Duckham Co. (1920) Ltd., and Hadfields Ltd.

The modern development of refractory materials owes much to close co-operation between manufacturer and user of refractories. As Britain's leading manufacturers, General Refractories enjoy the custom and confidence of many thousands of refractories users engaged in every branch of the metallurgical, engineering and other industries of the world. This intimate relationship is fostered by General Refractories because it provides "G.R." engineers and chemists with a real close-up picture of the actual needs of every type of user. In addition, it provides an invaluable fund of practical experience—which proves the soundest basis on which to maintain and develop a high standard of consistently uniform quality products. This method of procedure is your assurance that there is not only a "G.R." product made for your particular business—but that if you have a problem involving refractories, "G.R." data and experience will help you to find the answer. We want you to feel free to consult the "G.R." Technical Advisory Section at all times. It will enable you to tap this vast organisation for the greater efficiency of your business or plant.

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FIREBRICKS: *Glenboig Special, Glenboig Special Crown, Glenboig, Glenboig Crown, Castlecary, Dykehead, Gem, White Carr, Stour, Hycone, Alumantine, Hysilyn, Adamantine, Llangennech.*
BASIC BRICKS: *Spinella, Saxpyre, Supermag, Diazite, Dolomax.*
ACID-PROOF REFRACTORIES: *Obsidianite, Losol.*

INSULATION: *Amberlite* Bricks, Cement and Concrete.
SILICA BRICKS: *Lowood, Meltham, Allen, Quartex.*
CEMENTS: *Sintex, Durax, Pyrolyte.* PLASTICS: *Durax, Rotaline, Plastic K-N., Glendoline, Ground Ganister.*
SILLIMANITE: Tank Blocks, Bricks and Cements.
SANDS: Moulding, Brick Facing, Silica, Glass.

Raw Material Markets

There has not been the usual rush this year to secure additional supplies of iron and steel before the Christmas and New Year holidays. Distribution is now very carefully controlled, and consumers engaged on work of high priority are assured of all the material required to tide them over holiday periods. Lost time on this occasion has not been extensive at either the producing or consuming works, so that consumption of iron and steel will not be greatly affected. It is usual at this time of the year for buyers to undertake annual inventories, but in many cases these will not be necessary; if they are, they will be carried out with little, or no, curtailment of deliveries.

Pig-Iron

MIDDLESBROUGH—Supplies of high-phosphorus iron have been coming through satisfactorily, but it is evident that, with the granting of purchasing licences for the first quarter of 1942, buyers are losing no time in booking their quotas. The buying movement has been further stimulated by the immediate deduction of the loyalty rebates. Most of the foundrymen in this district are devoting their attention to the needs of Government departments, whose requirements of heavy castings are maintained at a high level. Makers of light castings, on the other hand, continue to be on the quiet side, and there is little reason to expect any improvement in this section, which depends so much on ordinary domestic business and exports, both of which have fallen away owing to wartime restrictions. Special irons and steel scrap are being used in place of hematite by many heavy engineers, as supplies of the latter are still as difficult as ever, being released only in cases of special need. Quite extensive stocks of hematite are being held by the Control authorities, and their value is certain to increase as production of war materials is expanded in the New Year.

LANCASHIRE—Licences for the first period of next year have been issued to consumers in the Lancashire area and, consequently, consumers have recently displayed more interest. Users are now permitted to cover their requirements over the first few months of 1942, and ironmakers in the Derbyshire and Staffordshire areas are receiving a steady flow of orders. Ample supplies are available and there is no reason to envisage any slowing down of deliveries in the New Year. The speciality engineers continue to be busily employed on urgent work for Government departments and other important buying agencies, but variable conditions are prevailing at most jobbing and light-castings foundries.

MIDLANDS — Machine-tool, munitions and armament makers are all helping to keep the heavy engineers in full production, and there is every indication that business in this section will remain active over a long period. All available plant is in operation and extensions are being made where possible. Only a small number of light foundries are fully engaged, as these works, generally speaking, cannot cope with the products needed by Government buyers. Their position has been worsened by the restrictions governing ordinary domestic trade and the export market, these outlets being the mainstays of the light foundry trade in normal times. In existing circumstances it is highly improbable that there will be any relaxation of the restrictions, so that prospects are anything but bright for the New Year. Supplies of high-phosphorus iron are plentiful, but low- and medium-phosphorus grades have to be carefully distributed, while the supply of hematite is even more stringent. Refined iron and steel scrap are coming forward fairly well in most instances, and are being used quite extensively by the heavy engineers, although more steel scrap would be appreciated. Foundries are getting liberal quantities of cast-iron scrap.

SCOTLAND—While pig-iron deliveries are sufficient to enable users to maintain steady working conditions, there is no surplus and few consumers have any reserve available. Marine and heavy engineers generally are extremely busy and are making substantial demands on the ironworks. The situation among makers of light castings is variable, but most of them would willingly accept fresh commitments were they offered. While basic iron is reaching the steelworks satisfactorily, hematite is still only handed out to works which cannot operate efficiently without this grade.

Coke

Deliveries of foundry coke under contracts continue to be regularly forthcoming and the supply position generally is very satisfactory. Consumers have considerable reserves on hand and are booked up over several months ahead at current prices. For Durham best coke, delivered stations in the Birmingham and Black Country districts, the quotation is 62s. 9d. per ton, this price being subject to a rise-and-fall clause.

Steel

There has been a definite falling away of business in ordinary commercial steel. This is emphasised by the quicker delivery periods which are indicated for many products. Structural engineers and other consumers of mild steel, for example, are getting their needs met much more expeditiously than before by both the steelworks and the rollers. The accent in the steel industry is, of course, on the production of special qualities, which are demanded by armament and munitions makers on an ever-increasing scale.

Scrap

While demand for iron and steel scrap is already at a high level, it is confidently expected that there will be further expansion early in the New Year. Steelmakers, of course, are absorbing a large proportion of the available supply of scrap, but foundrymen are also in the market for appreciable tonnages in the aggregate and, generally, are getting adequate despatches.

Metals

COPPER—There is no indication that supplies of copper are failing to reach the consuming points satisfactorily, and there is every reason to believe that deliveries will be fully maintained. Working-up industries are being called upon for ever-increasing outputs, so that the New Year is bound to witness heavier consumption of the red metal. The American price of electrolytic copper is still fixed at 12 cents per lb., delivered Connecticut Valley, while the export price is largely nominal at 11.25 cents per lb., f.a.s.

TIN—An announcement from Washington states that the Office of Production Management has assumed full control of tin supplies as well as consignments afloat from the Far East. The O.P.M. has decreed that no sales or deliveries be made without specific permission, and that in future imports may only be sold to the Metals Reserve Company or other Government agencies.

In London trading in tin is entirely suspended, and the market is awaiting details for the settlement of outstanding tin commitments which are still under discussion between the Metal Exchange and the Ministry of Supply. It has been announced that members of the Exchange who sold tin prior to the initiation of control for delivery to consumers after the control date can now fulfil their commitments by application to the Ministry of Supply, arrangements having been made to sell to them the metal required. No prices are indicated.

The question of the export tax on tin ore from British Malaya has been raised in Parliament several times recently. Mr. David Adams asked the Under-Secretary of State for the Colonies whether there were other similar instances within the British Empire of discrimination against raw material buyers of non-British nationality; and whether, in view of the principles of the Atlantic Charter, he would consider the cancellation of the Malayan tax in question. In reply, Mr. George Hall said the export duty on tin ore in various Malay States was an essential element in the revenue of those States. He assumed that Mr. Adams was referring to the additional export duty on tin ore exported to foreign destinations. This additional duty was imposed many years ago in order to protect the British and Malayan smelting industries against a threat of subsidised competition from abroad. The differential duty applied only to tin ore, not to smelted tin, which was the raw material required by industry in general. There were no other similar additional export duties in the British Colonial Empire; but there were a number of export duties, not differential in character, imposed for revenue purposes in various Colonial territories. As the export of tin ore from Malaya would involve uneconomic use of shipping space and packing materials, it would impede our war effort. The principles of the Atlantic Charter were fully met by the fact that there was no discrimination between British and foreign purchasers of Malayan smelted tin, except, of course, that necessitated by the state of war now existing.

SPELTER—Demand for spelter in connection with the armaments drive is impressive, and consumers of the metal excluded from the priority lists are unable to acquire more than a very small proportion of their requirements. Brassmakers are well supplied with Government orders, while galvanisers are largely dependent on contracts of the Government departments, as they cannot secure much work from other sources.

LEAD—The munitions programme is absorbing an increasing tonnage of lead, although this metal is still not quite so important to war production as other non-ferrous metals. Manufacturers of batteries and cables are busily employed, mostly on business for the various Government departments.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

538,901 CONSOLIDATED MINING & SMELTING COMPANY OF CANADA, LIMITED. Method of treating manganese and manganese alloys for the reduction of the boron content.

538,973 BRASSERT & COMPANY, LIMITED, H. A., and COLCLOUGH, T. P. Open-hearth and like heating furnaces.

538,988 URMENYI, L. Method of and device for electrically measuring the thickness of foils and sheet metals.

539,424 DEHN, F. B. (Sharon Steel Corporation). Method and apparatus for electrically pickling stainless steels.

539,456 NATIONAL SMELTING COMPANY. Aluminium base alloys.

539,461 RENNERFELT, I., and KALLING, B. M. S. Production of low-carbon alloys.

539,470 LINDE AIR PRODUCTS COMPANY. Deseaming or desurfacing metal bodies.

539,474 BENNETT, O. G., and BERGER, L. B. Bonding of refractory material.

539,516 HAMILTON, W. B. Conversion of powdered or sub-divided magnesium or magnesium alloys into coherent form.

539,529 METCALFE, H. Means for supplying heated air to furnaces and the like.

539,555 GENERAL ELECTRIC COMPANY, LIMITED, JENKINS, I., and WILLIAMS, S. V. Bright annealing of ferrous metals.

539,556 GENERAL ELECTRIC COMPANY, LIMITED, JENKINS, I., and WILLIAMS, S. V. Bright annealing of copper and its alloys.

539,590 BRITISH ALUMINIUM COMPANY, LIMITED, and PULLEN, A. N. D. Surface treatment of aluminium and aluminium alloys.

539,618 LOBLEY, A. G., and BIRMINGHAM ELECTRIC FURNACES, LIMITED. Heat-treatment of light metals and alloys.

539,621 KODAK, LIMITED, and MARRIAGE, A. Method of depositing metals on surfaces.

539,635 WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED, and SCOTT, G. A. Continuous-heating furnaces.

539,638 ADLER, R. Producing a carburising material for hardening ferrous metals.

539,830 BARON, T., and WEINBERGER, R. Method and means for sealing sheet-metal boxes.

539,861 MAGNAL PRODUCTS, LIMITED, ALLEN, F. A., MORGAN, J., and MAGNESIUM ELEKTRON, LIMITED. Treatment of magnesium and magnesium alloys for rendering them corrosion resistant.

539,894 BRITISH ROLLING MILLS, LIMITED, and MORRISON, G. B. Manufacture of steel.

539,957 LUCAS, L. R. J. Refractory material, such as high-temperature insulation bricks for furnace linings and the like.

539,983 TRIGGS, W. W. (Valley Mould & Iron Corporation). Casting of metal ingots and ingot moulds for use therein.

JAN 26 1942

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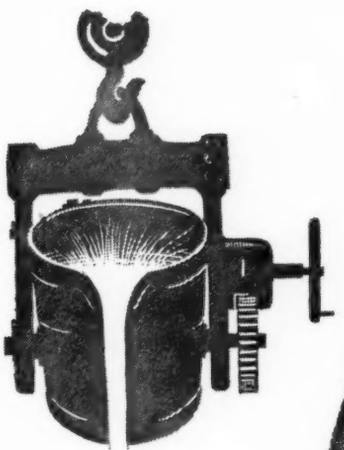

Telegrams: Ironobrit, Phone, Woking.

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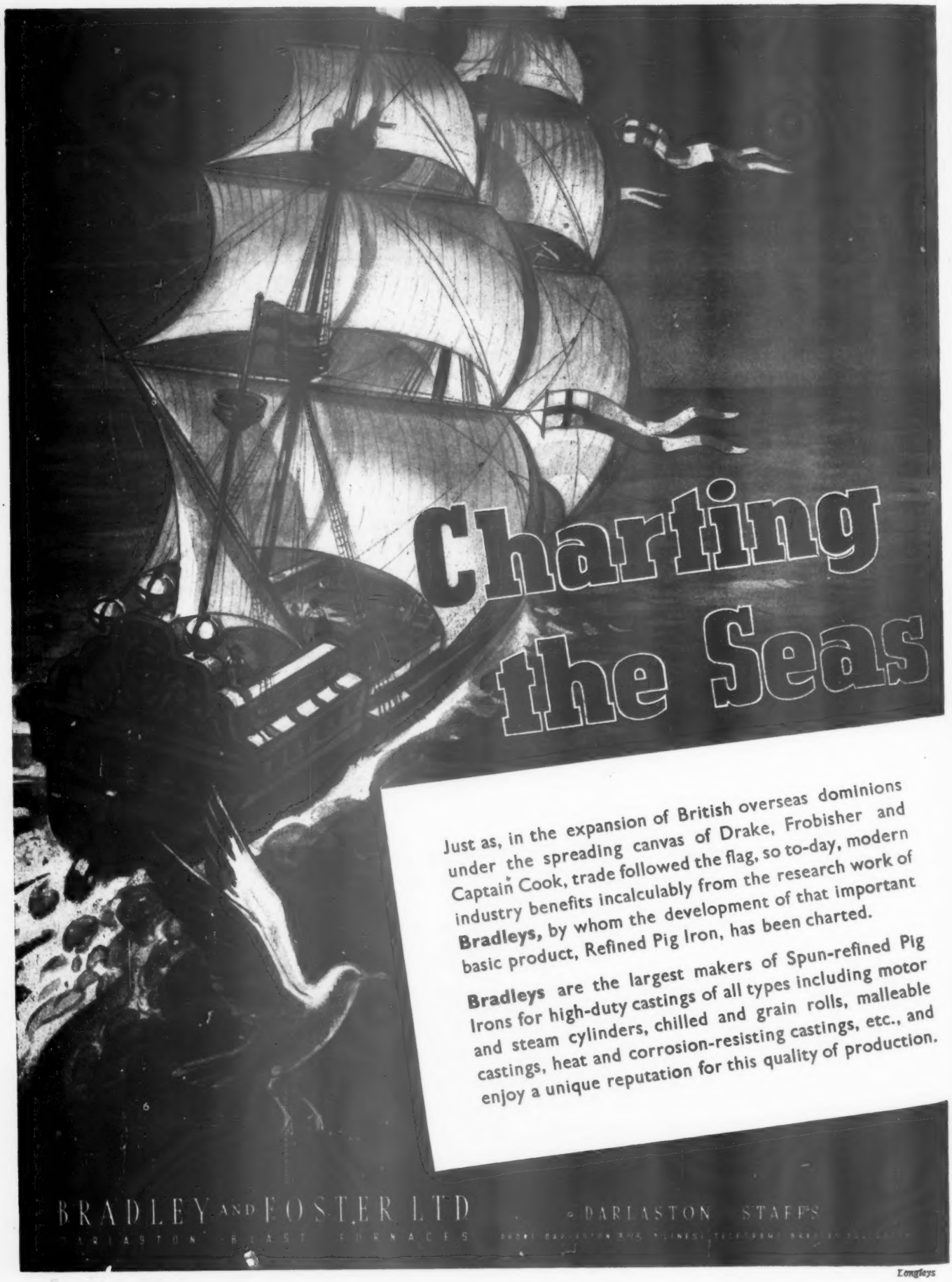
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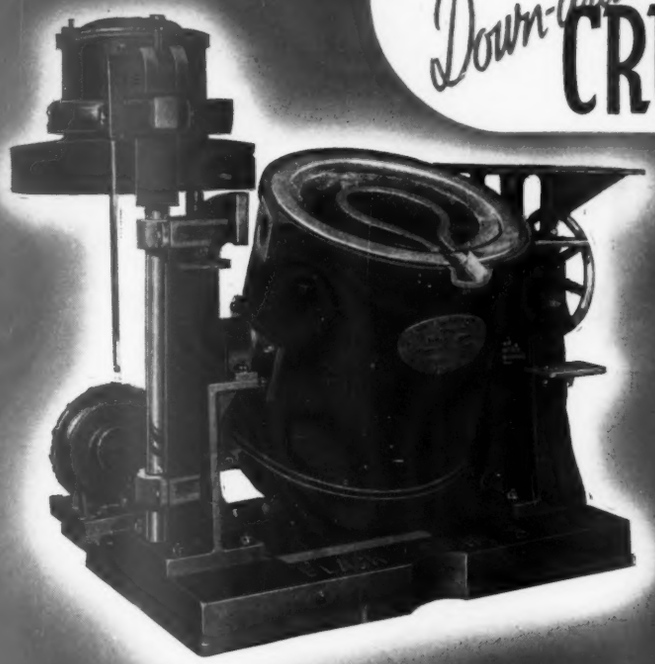

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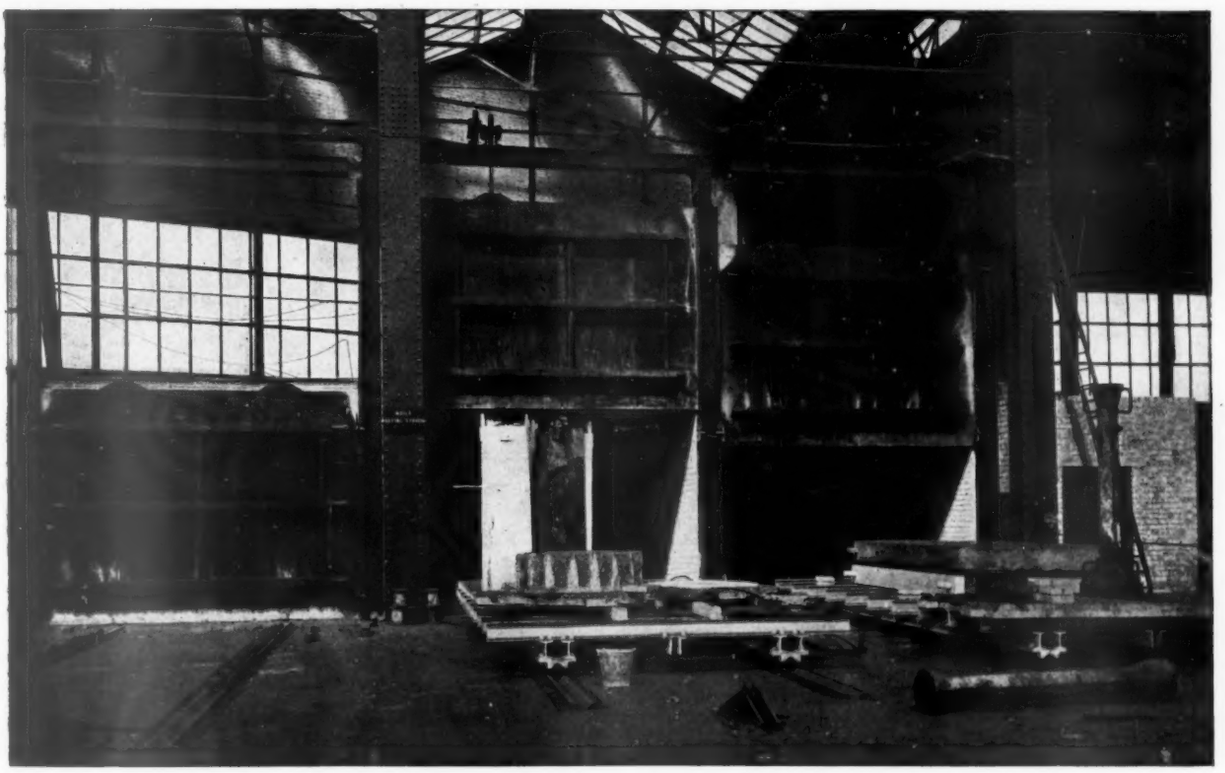

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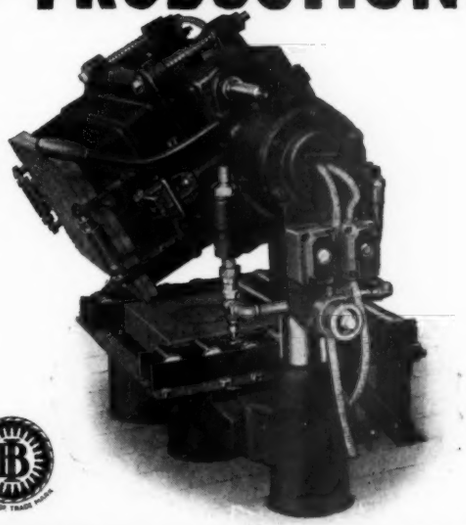

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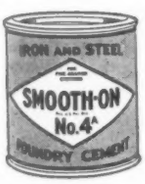

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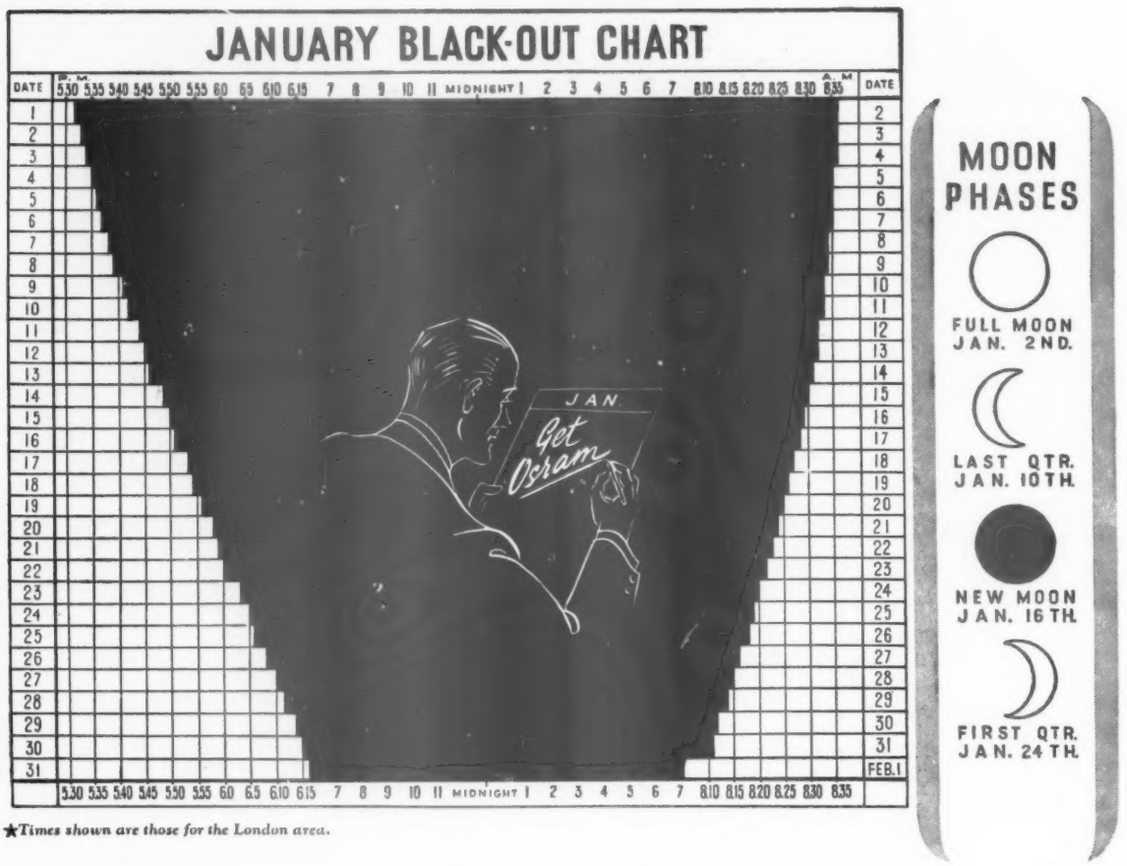
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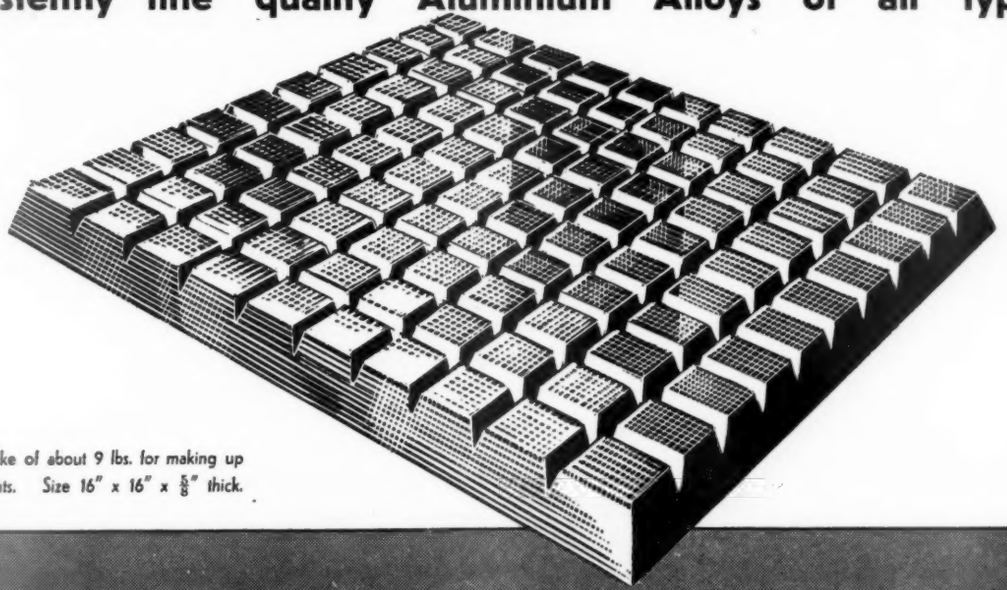

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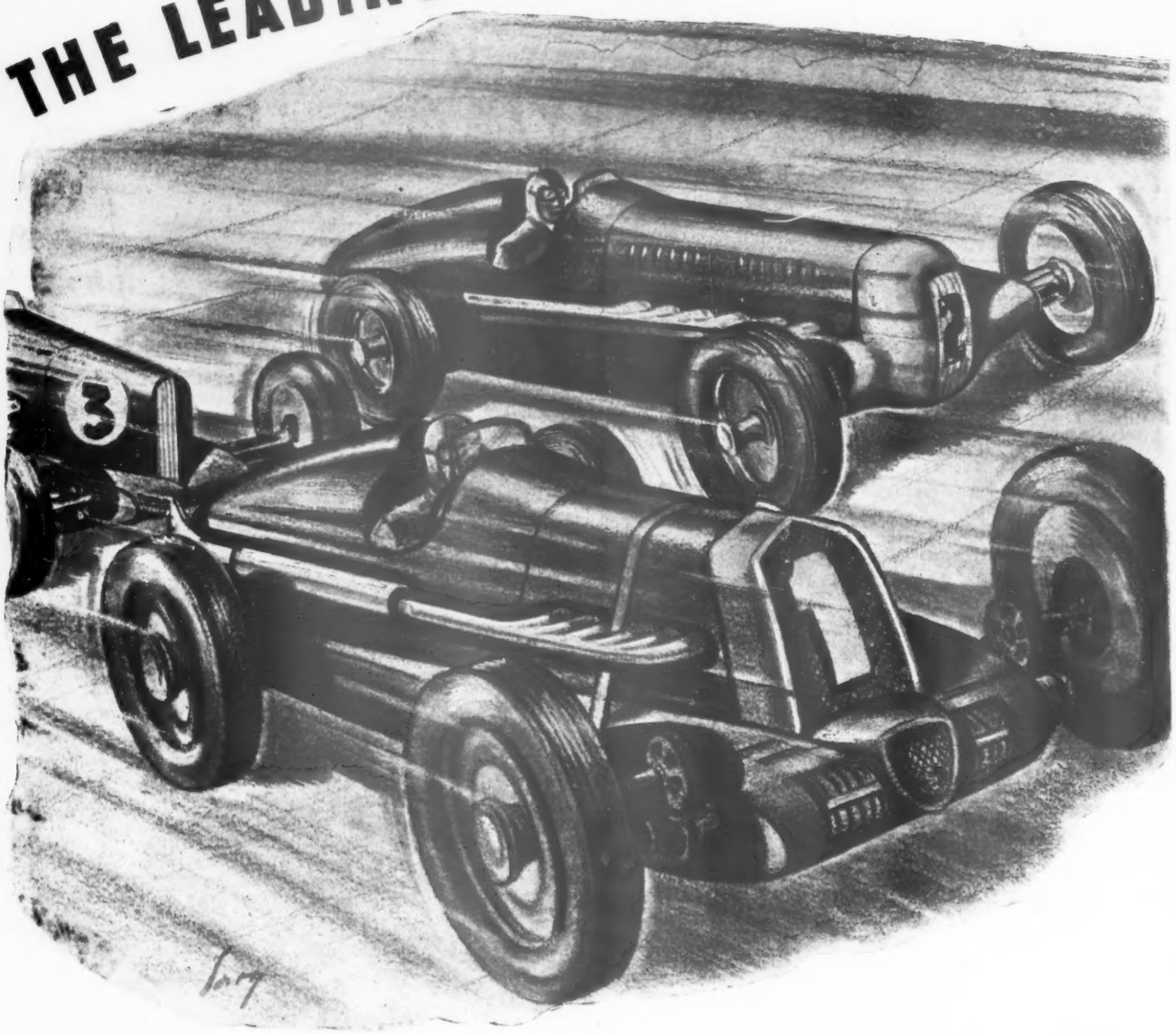

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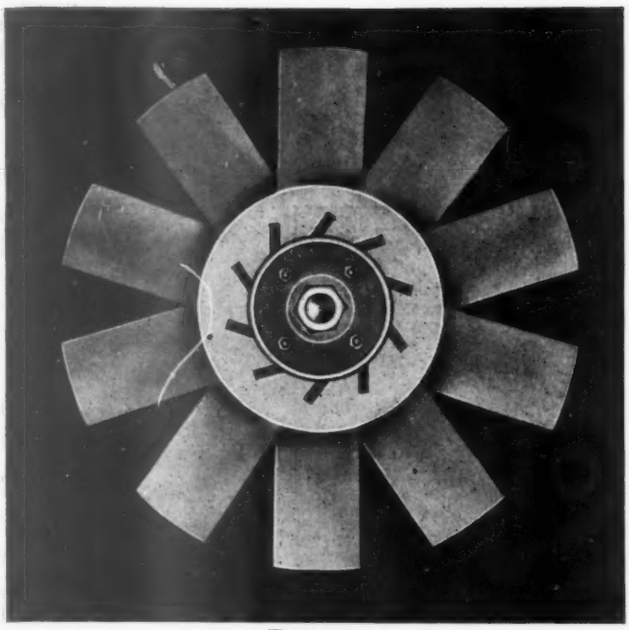

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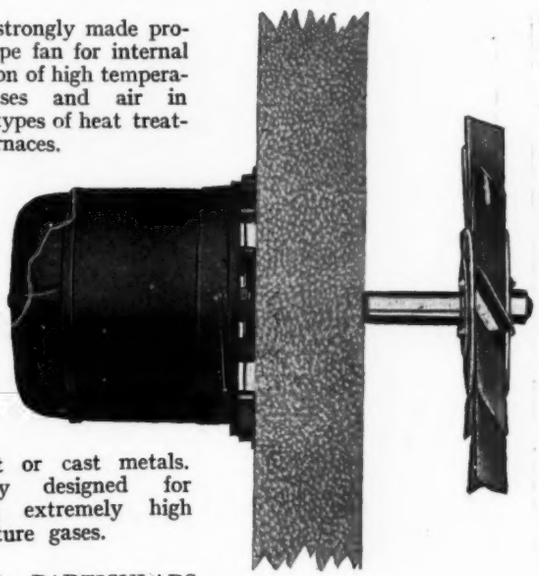

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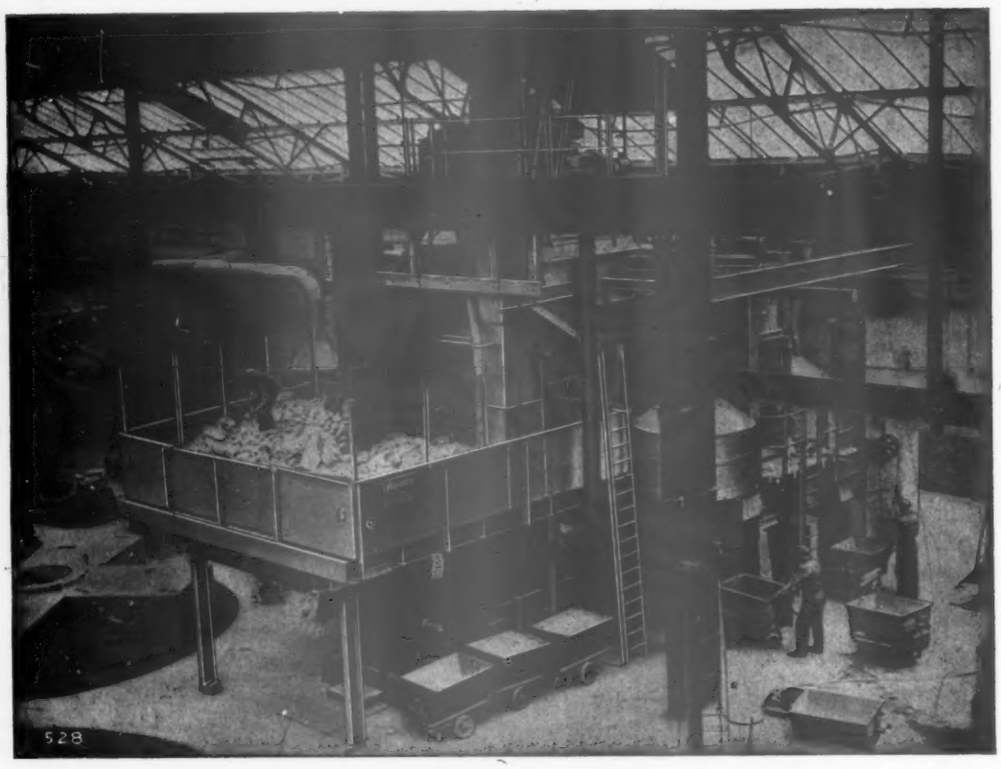
Price, J. T., & Co., Ltd.	—
Rapid Magnetting Machine Co., Ltd.	—
Reavell & Co., Ltd.	—
Richardson, R. J., & Son, Ltd.	—
Ridsdale & Co., Ltd.	—
Riley Stoker Co., Ltd.	—
Robson Refractories, Ltd.	1
Roper, E. A., & Co.	—
Rowland, F. E., & Co., Ltd.	411
Rustless Iron Co. Ltd., The	9
St. George's Engineers, Ltd.	19
Safety Products, Ltd.	—
Sheepbridge Coal & Iron Co., Ltd.	—
Smith, Albert, & Co.	—
Smooth-On Mfg. Co.	9
Sommerfield, H. G., Ltd.	—
Spencer & Halstead, Ltd.	—
Spermolin, Ltd.	—
Stanton Ironworks Co., Ltd., The	409
Staveley Coal & Iron Co., Ltd.	—
Steel, John	—
Steele & Cowlishaw	—
Stein & Atkinson, Ltd	—
Stein, J. G., & Co., Ltd.	—
Sterling Foundry Specialties, Ltd.	6
Sternol, Ltd.	15
Stewarts and Lloyds, Ltd.	—
Surrey Industries, The	20
Teisen, Th.	—
Thermic Equipment & Engg. Co., Ltd.	—
Tilghman's Air Compressor Co.	—
Tilghman's Patent Sand Blast Co., Ltd.	2
Trenmans, Ltd.	—
Tungum Sales Co., Ltd.	26
United Steel Companies, Ltd., The	—
Vaughan, Jones & Co.	—
Vickers-Armstrongs, Ltd.	—
Walker, I. & I.	30
Walsall Sandblasting Co., Ltd., The	20
Ward, Thos. W., Ltd.	1 & 18
Waring Bros.	—
Warner & Co., Ltd.	413
Watson's (Metallurgists), Ltd.	—
Webster & Co. (Sheffield), Ltd.	—
Wengers, Ltd.	—
West Midland Refining Co., Ltd.	27
Wilkinson, Thos., & Co, Ltd.	—
Woodward Bros. & Copelin, Ltd.	—
Workington Iron & Steel Co. (Branch of The United Steel Companies, Ltd.)	—

NOTICE.—*The fact that goods made of raw materials in short supply owing to war conditions are advertised in this paper should not be taken as an indication that they are necessarily available for export.*

August's



An August's Sand Reclamation and Preparation Plant for the Randupson Process.

Courtesy of Manganese Bronze and Brass Co. Ltd.

Recent progress in Scientific Control of Founding Processes is not confined to the Iron and Steel branches of the industry—the non-ferrous foundries are very alive to modern advances too.

August's are assisting in these developments; J. Stone & Co., Ltd., Magnesium Castings & Products Ltd., Shipham & Co., Ltd., John Holroyd & Co., Ltd., amongst other well-known non-ferrous founders are installing August's mechanisation.

"The Specialists in Foundry Mechanisation"

whose products

"Set the Standard by which Foundry plant is judged."

August's

LIMITED

Phones: 61247 & 8. **HALIFAX, ENGLAND** *'Grams:* August, Halifax

Sole Licensees and manufacturers for British Empire (excluding Canada) of the Simpson Sand Mixer

FOR WORKING TO MACHINE SHOP TOLERANCES

Machine shops will not tolerate wide margins in castings.

STERNOCORE High Efficiency Core Oils, Creams and Compounds are great aids to working to these exacting standards.

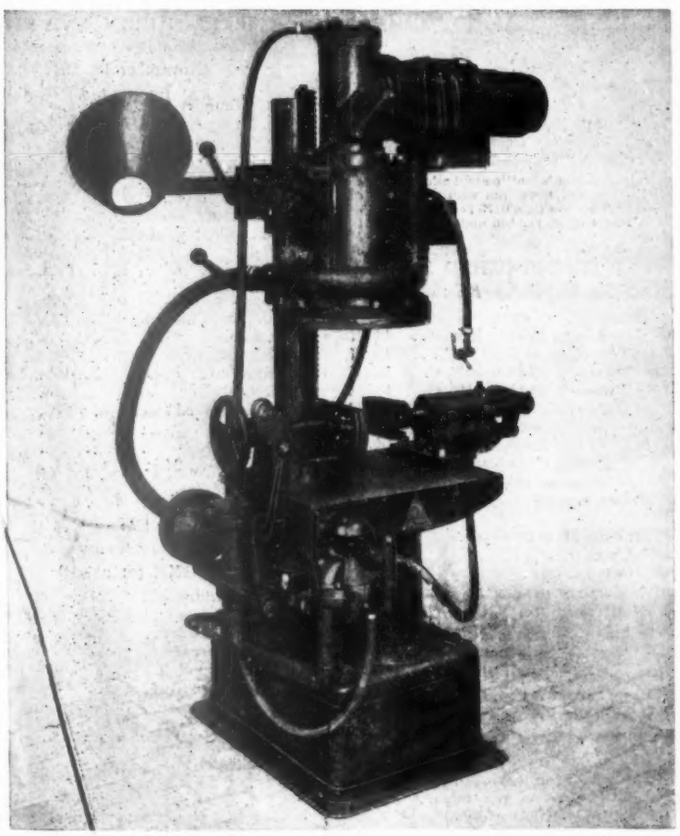
For accurate cores, easier working, cleaner finish, reduced fettling, quicker drying, higher permeability, low and less objectionable gas evolution — and for lower true cost, stipulate . . .

STERNOCORE

High efficiency CORE OILS · CREAMS & COMPOUNDS

STERNOL LTD., FINSBURY SQUARE, LONDON, E.C.2.

Telephone: Kelvin 3871-2-3-4-5. Telegrams: "Sternoline, Phone, London." Also at Bradford and Glasgow.



Is Core Production Your Bottle-Neck?

Titan Core Machines are daily solving new core-making problems

SAVING IN SKILLED LABOUR—a girl can operate our machine. Intricate cores may be blown in one operation (one movement of the hand lever).

FASTER PRODUCTION—up to tenfold increase over hand methods.

BETTER CORES of uniform quality—greater strength and maximum permeability.

THE CONSTRUCTIONAL ENGINEERING Co LTD

Telephone: MID 4753-4

TITAN WORKS BIRMINGHAM 12

Telegrams: "Structual, Birmingham"

The machine illustrated is fitted with a sand container of 75 lbs. capacity (which can be re-charged in a couple of minutes) motor-driven sand agitator, automatic compressed air horizontal clamp, and takes boxes up to 20 ins. long x 12 ins. wide x 24 ins. high without removing the clamps.

RAW MATERIALS—PRICE LIST

Tuesday, December 23, 1941

COPPER*

	£	s.	d.
Electrolytic	62	0	0
High-grade fire-refined	61	10	0
Fire-refined of not less than 99.7 per cent.	61	0	0
Do., do., 99.2 per cent.	60	10	0
Black hot-rolled wire rods	65	10	0

TIN

Standard cash			—
Three months			—
Settlement			—
Official average Cash, Nov.	256	17	6
Do. Three Months, Nov.	260	8	0
Do. Settlement, Nov.	256	17	9

SPELTER*

G.O.B. (foreign) (duty paid)	25	15	0
Do. (domestic)	26	10	0
"Prime Western"	26	10	0
Refined and electrolytic	27	5	0
Not less than 99.99 per cent.	28	15	0

LEAD*

Good soft pig-lead (foreign) (duty paid)	25	0	0
Do., do., (Empire and domestic)	25	0	0
English	26	10	0
Sheets, home	35	10	0
Do. export, f.o.b.	31	0	0
Pipes, home	35	0	0
Do. export, f.o.b.	31	10	0
Tea lead (nom.)			—

ALUMINIUM

Ingots	110	0	0
Wire, 10g.			nom.
Sheets			nom.
Circles, 20/24g.			nom.

ZINC SHEETS, etc.

Sheets, 10g. and thicker, ex works	39	2	6
Rolled zinc (boiler plates), ex works	37	2	6
Zinc oxide (Red Seal), d/d buyers' premises	28	7	6

ANTIMONY

English, 99%, delivered	120	0	0
Crude, spot, home trade	100	0	0

QUICKSILVER

Quicksilver, ex w'hse London	47	15	0

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s.	0d.
Finished bars, 18% tungsten	3s.	10d.
Finished bars, 22% tungsten	4s.	4d.

Per lb. d/d buyers' works.

NICKEL SILVER, etc.

	Per lb.
Ingots for raising	10d. to 1/4
Rolled—	
To 9 in. wide	1/4 to 1/10
To 12 in. wide	1/4½ to 1/10½
To 15 in. wide	1/4½ to 1/10½
To 18 in. wide	1/5 to 1/11
To 21 in. wide	1/5½ to 1/11½
To 25 in. wide	1/6 to 2/–
Ingots for spoons and forks	10d. to 1/6½
Ingots rolled to spoon size	1/1 to 1/9½
Wire round—	
To 10g.	1/7½ to 2/2½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/6½ upwards.

* Maximum prices, per long ton delivered to buyers' premises.

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon (5-ton lots)—			
25%	21	5	0
45%	23	10	0
75%	36	10	0
Ferro-vanadium—			
35/50%	15/6 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	6/– lb. Mo.		
Ferro-titanium—			
20/25% carbon-free	1/9 lb.		
Ferro-tungsten—			
80/85%	5/1 lb.		
Tungsten metal powder—			
98/99%	5/2½ lb.		
Ferro-chrome—			
2/4% car.	—		
4/6% car.	47	0	0
6/8% car.	47	0	0
8/10% car.	—		
Ferro-chrome—			
Max. 2% car.	1/0½ lb.		
Max. 1% car.	1/1½ lb.		
Max. 0.5% car.	1/1½ lb.		
70% carbon-free	—		
Nickel—99.5/100%	£190 to £195		
"F" nickel shot	175	0	0
Ferro-cobalt, 98/99%	8/9 lb.		
Metallic chromium—			
96/98%	3/9 lb.		
Ferro-manganese—			
76/80% loose	18	10	0
76/80% packed	20	0	0
Metallic manganese—			
94/96% carbon-free	1/9 lb.		

Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.

SCRAP*

	£	s.	d.	£	s.	d.
SOUTH WALES—						
Short heavy steel, not ex. 24-in. lengths	4	2	0	to 4	4	6
Heavy machinery cast iron				4	7	0
Ordinary heavy cast iron				4	2	0
Cast-iron railway chairs				4	7	0
Medium cast iron				3	18	3
Light cast iron				3	13	6
MIDDLESBROUGH—						
Short heavy steel	3	19	9	to 4	2	3
Heavy machinery cast iron				4	11	9
Ordinary heavy cast iron				4	9	3
Cast-iron railway chairs				4	9	3
Medium cast iron				3	19	6
Light cast iron				3	14	6
BIRMINGHAM DISTRICT—						
Short heavy steel	3	14	9	to 3	17	3
Heavy machinery cast iron				4	12	3
Ordinary heavy cast iron				4	7	6
Cast-iron railway chairs				4	7	6
Medium cast iron				4	0	3
Light cast iron				3	15	3
SCOTLAND—						
Short heavy steel	3	19	6	to 4	2	0
Heavy machinery cast iron				4	14	3
Ordinary heavy cast iron				4	9	3
Cast-iron railway chairs				4	14	3
Medium cast iron				3	17	3
Light cast iron				3	12	3

* Delivered free to consumers' works in England and Wales. For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less. All prices: Plus 3½ per cent. dealers' remuneration: 50 tons and upwards over three months 2s. 6d. extra.

PIG-IRON*

	£	s.	d.
N.E. COAST (d/d Tees-side area)—			
Foundry No. 1	131/–		
„ No. 3	128/–		
„ No. 4	127/–		
Forge No. 4	127/–		
Hematite No. 1	138/6		
Hematite M/Nos.	138/–		
N.W. COAST—			
Hem. M/Nos. d/d Glasgow	138/6		
„ d/d Birmingham	150/–		
MIDLANDS (d/d Birmingham dist.)—			
Staffs No. 4 forge	129/–		
„ No. 3 fdry.	130/–		
Northants forge	126/6		
„ fdry. No. 3	127/6		
„ fdry. No. 1	130/6		
Derbyshire forge	129/–		
„ fdry. No. 3	130/–		
„ fdry. No. 1	133/–		
Phosphorus 0.5% to 0.75%	137/6		
Phosphorus 0.1% to 0.5%	140/6		
SCOTLAND—			
Foundry No. 1, Grangemouth	127/3		
„ No. 3, Grangemouth	124/9		
Cleveland No. 3, Glasgow	131/–		
„ „ Falkirk	128/–		
Scottish hem. M/Nos. d/d	138/6		
SHEFFIELD (d/d district)—			
Derby forge	126/6		
„ fdry. No. 3	127/6		
Lincs. forge	126/6		
„ fdry. No. 3	127/6		
W.C. hematite	144/–		
LANCASHIRE (d/d eq. Man.)—			
Derby fdry. No. 3	133/–		
Staffs fdry. No. 3	133/–		
Northants fdry. No. 3	131/6		
Cleveland fdry. No. 3	133/–		
Cylinder and Refined Irons.			
North Zone	174/–		
South Zone	176/6		
Refined Malleable.			
Birmingham and S. Staffs	171/6		
Cold Blast.			
South Staffs	220/6		

* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.

	£	s.	d.
BASIC:			
Soft, u.t., 100-ton lots	12	5	0
Tested, up to 0.25% C.	12	10	0
Tested, 0.25 to 0.33% C.	12	12	6
Tested, 0.33 to 0.41% C.	12	15	0
Hard (0.42 to 0.60% C.)	13	17	6
„ (0.61 to 0.85% C.)	14	7	6
„ (0.86 to 0.99% C.)	14	17	6
„ (1% C. and up)	15	7	6
Silico-manganese	17	5	0
Free-cutting	14	10	0
SIEMENS MARTIN ACID:			
Up to 0.25% C.	15	15	0
Case-hardening	16	12	6
Silico-manganese	17	5	0

Billets, Blooms and Slabs for Forging and Stamping.

Basic soft, up to 0.25% C.	13	17	6
Basic hard, 0.41 to 0.60% C.	14	10	0
Acid, up to 0.25% C.	16	5	0

Other Semi-products, etc.

Tin bars, 6-ton lots	12	2	6
Sheet bars, 6-ton lots	12	2	6
*Wire rods, soft basic	17	7	6
„ hard basic	21	2	6
„ free-cutting	20	2	6
„ acid	24	13	6

* Subject to rebate.

FINISHED STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel bars, sections plates, joists and hoops is obtainable in the home trade under certain conditions.]

	£	s.	d.
Plates, ship (N.E. Coast)	16	3	0
Boiler plts. (N.E. Coast)	17	0	6
Chequer plts. (N.E. Coast)	17	13	0
Angles, over 4 un. ins.	15	8	0
Tees, over 4 un. ins.	16	8	0
Joists, 3 in. × 3 in. and up	15	8	0
Rounds and squares, 3 in. to 5½ in.	16	8	0
Rounds under 3 in. to ⅜ in. (untested)	17	12	0
Flats—over 5 in. wide	15	13	0
„ 5 in. wide and under	17	12	0
Rails, heavy, f.o.t.	14	10	6
Hoops	18	7	0
Black sheets, 24 g. (4-t. lots)	22	15	0
Galv. cor. shts. („)	26	2	6
Galv. flat shts. („)	26	12	6
Galv. fencing wire, 8g. plain	26	17	6

FINISHED IRON

	£	s.	d.
CROWN IRON:			
England and Wales	15	12	6
Scotland	15	12	6
Ireland, f.o.q.	16	5	0
No. 3 BARS:			
England and Wales	12	10	0
Scotland	13	12	6
Ireland, f.o.q.	13	2	6
No. 4 BARS:			
England and Wales	13	0	0
Scotland	13	17	6
Ireland, f.o.q.	13	12	6
STRIP:			
England and Wales	17	0	0
STAFFS MARKED BARS, f.o.t.	18	10	0

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

(November 18, 1941.)

	Dols.
No. 2 foundry, Phila.	25.84
No. 2 foundry, Valley	24.00
No. 2 foundry, Birm.	20.38
Basic, Valley	23.50
Malleable, Valley	24.00
Grey forge, Valley	23.50
Ferro-mang., seaboard	120.00
O.-h. rails, h'y, at mill	40.00
Billets	34.00
Sheet bars	34.00
	Cents
Iron bars, Chicago	2.25
Steel bars	2.15
Tank plates	2.10
Beams, etc.	2.10
Wire rods	2.00
Skelp, grooved steel	1.90
Steel strip	2.10
Steel sheets	2.10
Sheets, galv., 24 g.	3.50
Wire nails	2.55
Plain wire	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens)

Welsh foundry	50/–
„ furnace	36/9 to 38/9
Durham foundry	46/9
„ furnace	36/9
Scottish foundry	42/6 to 52/6
„ furnace	36/9

TINPLATES

I.C. cokes	20 × 14	per box	30/9
„	28 × 20	„	61/6
„	20 × 10	„	44/3
„	18¾ × 14	„	32/–
C.W. „	20 × 14	„	28/6
„	28 × 20	„	57/–
„	20 × 10	„	42/3 to 42/9
„	18¾ × 14	„	30/– to 30/6

NON-FERROUS SCRAP

(Official Maximum Prices, per ton ex Works.)

	£ s. d.
Bright untinned copper wire, in crucible form or in hanks	57 10 0
No. 1 copper wire	57 0 0
No. 2 copper wire	55 10 0
Copper firebox plates, cut up	57 10 0
Clean untinned copper, cut up	56 10 0
Braziery copper	53 10 0
Q.F. process and shell-case brass, 70/30 quality, free from primers	49 0 0
Clean fired 303 S.A. cartridge cases	47 0 0
70/30 turnings, clean and baled	43 0 0
Brass swarf, clean, free from iron and commercially dry	34 10 0
New brass rod ends, 60/40 quality	38 10 0
Hot stampings and fuse metal, 60/40 quality	38 10 0
Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin	72 0 0

NEW BRASS TUBES, etc.

	Per lb.
Solid drawn tubes	13½d.
Brazed tubes	15½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	8½d.
Sheets to 10 w.g.	10⅝d.
Wire	10⅜d.
Rolled metal	10d.
Yellow metal rods	8½d.

COPPER TUBES, etc.

Solid drawn tubes	15d.
Brazed tubes	15d.
Wire	9½d.

PHOSPHOR BRONZE

	Per lb. basis
Strip	13½d.
Sheet to 10 w.g.	14½d.
Wire	15⅝d.
Rods	15½d.
Tubes	21d.
Castings	17d.

Delivery 3 cwt. free.
10% phos. cop. £35 above B.S.
15% phos. cop. £40 above B.S.
Phosphor tin (5%) £40 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

AVERAGE MONTHLY PRICES OF DERBYSHIRE NO. 3 FOUNDRY AT MANCHESTER.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1905	2 13 0	2 13 0	2 11 6	2 12 6	2 12 0	2 12 0	2 12 3	2 12 3	2 14 0	2 16 6	3 0 0	3 0 6	2 14 1
1906	3 2 0	3 5 0	3 3 0	3 0 6	2 17 0	2 18 6	2 18 0	2 16 6	2 19 0	3 0 6	3 1 6	3 7 0	3 0 8½
1907	3 7 0	3 7 0	3 5 0	3 2 0	3 4 0	3 8 0	3 6 0	3 5 0	3 4 0	3 2 6	3 1 0	2 18 6	3 4 2½
1908	2 15 0	2 14 6	2 14 6	2 15 6	2 14 0	2 13 0	2 13 0	2 11 6	2 12 6	2 13 0	2 12 6	2 12 6	2 13 5½
1909	2 13 0	2 12 6	2 11 6	2 12 0	2 12 6	2 12 6	2 12 0	2 12 6	2 14 6	2 15 0	2 14 6	2 14 0	2 13 0½
1910	2 13 9	2 14 0	2 14 0	2 14 4	2 15 0	2 15 0	2 14 9	2 15 0	2 15 0	2 15 0	2 15 0	2 15 0	2 14 7½
1911	2 16 0	2 16 0	2 16 0	2 16 0	2 16 0	2 16 0	2 16 0	2 16 0	2 16 0	2 14 6	2 15 0	2 15 0	2 15 8
1912	2 17 4½	2 17 6	2 17 6	3 1 1½	3 2 6	3 3 9	3 6 3	3 7 6	3 10 10½	3 12 6	3 13 3½	3 14 6	3 5 4
1913	3 15 7	3 15 0	3 11 10½	3 11 4½	3 10 2½	3 6 10½	3 4 2½	3 2 9	3 1 9	3 1 0	2 19 3	2 17 2½	3 6 5
1914	2 17 2½	2 18 0	2 18 0	2 17 0	2 17 0	2 16 7½	2 16 0	3 2 10	3 1 0	2 19 9½	2 16 11½	2 18 1½	2 18 2½
1915	3 1 2	3 3 11	3 5 9	3 18 8½	3 13 7	3 14 1	3 15 0	3 13 3	3 12 0½	3 11 1	3 14 0	4 3 3	3 12 2½
1916	4 4 6½	4 11 6	4 11 6½	4 7 6	4 7 6	4 7 6	4 10 0	4 12 10	4 12 6	4 12 6	4 12 6	4 12 6	4 8 6
1917	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6
1918	4 12 6	4 12 6	4 12 6	4 12 5	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6	4 12 6
1919	4 12 6	4 12 6	4 12 6	4 12 6	7 2 6	7 5 0	8 8 5	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	7 3 10½
1920	9 13 9	10 0 0	10 5 3	10 15 3	11 10 0	12 2 6	12 5 0	13 1 3	14 7 6	14 5 0	14 5 0	14 5 0	12 12 1
1921	12 11 8	10 8 9	9 2 6	8 2 0	8 0 0	8 0 0	8 0 0	8 1 8	7 4 0	6 7 6	5 7 6	4 16 10	8 0 2½
1922	5 5 0	4 17 6	4 15 0	4 15 0	4 12 6	4 12 6	4 12 6	4 12 6	4 11 3	4 10 0	4 10 0	4 10 0	4 13 7½
1923	4 12 8½	5 0 2	6 2 6	6 8 7½	6 2 5	5 11 9	5 9 1½	5 4 0	5 0 0	5 0 9	5 0 7	5 2 9	5 7 11½
1924	5 3 0	5 3 0	5 3 0	5 3 0	5 2 10	5 1 3	4 17 11	4 15 6	4 13 6	4 10 1½	4 10 0	4 10 3	4 17 9
1925	4 10 0	4 9 0	4 6 9	4 5 2½	4 3 0	4 0 1½	4 17 1½	3 15 7½	3 14 3½	3 13 4½	3 13 4½	3 13 2½	4 1 9
1926	3 14 9	3 15 3	3 15 6	3 15 3½	3 17 6	4 5 9	4 16 9	*	*	*	*	4 12 6	4 0 1½
1927	4 13 9½	4 13 3	4 11 1½	4 9 4½	4 6 1½	3 19 1½	3 16 1½	3 15 6	3 13 4½	3 13 4½	3 14 0	3 13 6½	4 1 6½
1928	3 13 2½	3 12 3½	3 12 3	3 12 3	3 11 6	3 10 0	3 8 3	3 7 8½	3 7 6	3 7 9½	3 8 3	3 7 6	3 9 10½
1929	3 8 3½	3 10 4½	3 10 10½	3 11 0	3 11 2½	3 12 0	3 12 4½	3 14 6	3 15 1½	3 17 0	3 17 0	3 17 0	3 13 1½
1930	3 17 0	3 17 0	3 17 0	3 17 0	3 17 0	3 17 0	3 15 0	3 12 0	3 12 0	3 12 0	3 10 1½	3 9 6	3 14 4½
1931	3 9 6	3 9 6	3 9 6	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 10
1932	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0
1933	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0	3 7 0
1934	3 7 0	3 9 6	3 13 2½	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 12 11½
1935	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 14 0	3 18 0	3 18 0	3 14 8
1936	3 18 0	3 18 0	3 18 0	3 18 0	3 18 0	3 18 0	4 3 0	4 3 0	4 3 0	4 3 0	4 3 0	4 9 0	4 1 0
1937	4 9 0	4 9 0	4 9 0	4 9 0	4 9 0	4 9 0	5 9 0	5 9 0	5 9 0	5 9 0	5 14 0	5 14 0	4 19 10
1938	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0	5 14 0
1939	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 4 0	5 13 0	5 13 0	5 5 6
1940	5 13 0	5 16 0	5 16 0	5 16 0	5 16 0	5 16 0	6 5 0	6 5 0	6 5 0	6 5 0	6 13 0	6 13 0	6 1 7
1941	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	6 13 0	—	—

NOTE: Prices have been subject to a rebate of 5/- per ton since November 1, 1937. * No prices available during strike period.

WILLIAM JACKS & COMPANY LIMITED
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ZETLAND ROAD, MIDDLESBROUGH.

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Minimum charge for one insertion 4/-

Instructions for these advertisements, accompanied by a remittance, are accepted up to FIRST POST WEDNESDAY MORNING for insertion in the current week's issue. All communications to be addressed to the Advertisement Manager, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe, Bucks. The Proprietors reserve the right to refuse any advertisement they consider unsuitable.

SITUATIONS VACANT AND WANTED

FOUNDRY MANAGER requires position, full experience in all branches, particularly machine-tool castings, both jobbing and production. Salary £1,000 p.a.—Box 118, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

GERMAN REFUGEE, 62 years old but physically extremely fit, with life-long experience crucible steel production, seeks employment. First-class British references available.—Please reply, Box 984, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY TRADE.—Wanted, for established Ironfoundry in Lancashire, thoroughly experienced Manager, capable of organising new departments for light and heavy castings for the Building and General Engineering Trades, Municipalities, etc. Must be able to design parts for economic mass production and collaborate with principals in preparing compendious catalogue. Must have expert knowledge of moulding and be able to get the best results from men and materials. Really first-class man, keen and progressive, is required, and will be liberally considered as regards remuneration. Applicants please state age, experience in full, and salary expected.—Box 138, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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METALLURGIST or Metallurgical Chemist required for cupola control in iron-foundry making high-class castings for war work. Location Lancashire.—Write, stating full details of age, training, experience and salary required, Box 132, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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WANTED.—Experienced man to manage Refractory Works for duration. State age, experience, salary required.—Box 144, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

EMPLOYMENT REGISTER.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

NON-FERROUS Foundry Manager, age 32. Aluminium, aluminium and manganese bronzes. Castings to withstand high pressures. Full control foundry, pattern, dressing shops. Planning. Estimating. (418)

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3 ft. 8 in. swing, DUPLEX VERTICAL BORING AND TURNING MILL (Webster & Bennett), 3 ft. 4 in. dia. table each with 4 jaws, fast and loose pulley drive.

No. 7 WARD, ALL-GEARED HEAD FLAT TURRET LATHE, with collet head, arranged for Tex rope motor drive, fitted with suds pump, tray and piping. Various collets.

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One 4/5 tons per hour Cupola.

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Broadbent Brick Crusher.
Sandblasting Plant; 50 Air Compressors; 500 Electric Motors, Dynamos, etc.

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Lead Bronze	,,	,,	,,
Zinc Base Alloy	,,	,,	,,
Aluminium Bronze	,,	,,	,,
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Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

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Telephone Penistone 21 and 57 Telegrams: Blacking, Penistone

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COAL DUST. TALC
GANISTER. FOUNDRY SUPPLIES

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Should a representative of a firm wish to compile a list of potential customers in a certain district, he will find that he can make up an accurate list by turning to the Geographical Section, where all firms are listed in County and Town Groups. In another section are listed and illustrated the Trade Marks used in the heavy industries, which, in itself, saves much time and trouble, not only in identifying sources of supply, but in avoiding the selection of Marks already in use by others. The alphabetical section is of greater value than ever owing to the number of mergers that have taken place, and these have been dealt with in a very able manner, and in the more important cases, histories of the participating firms have been incorporated.

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UNIVERSAL IRON CEMENT *and* DIAMOND IRON CEMENT

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■ Powder for mixing only with SPECIAL LIQUID. For smoothing up rough places, filling up bursts and holes in all classes of Iron and Steel Castings, Wrought Steel, and Malleable Ironwork.

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Withstands temperatures and pressures. Has the appearance of, and sets as hard as, the iron itself in 48 hours. Can be machined. Unites perfectly with the metal. Expands in drying, forming a perfect joint.

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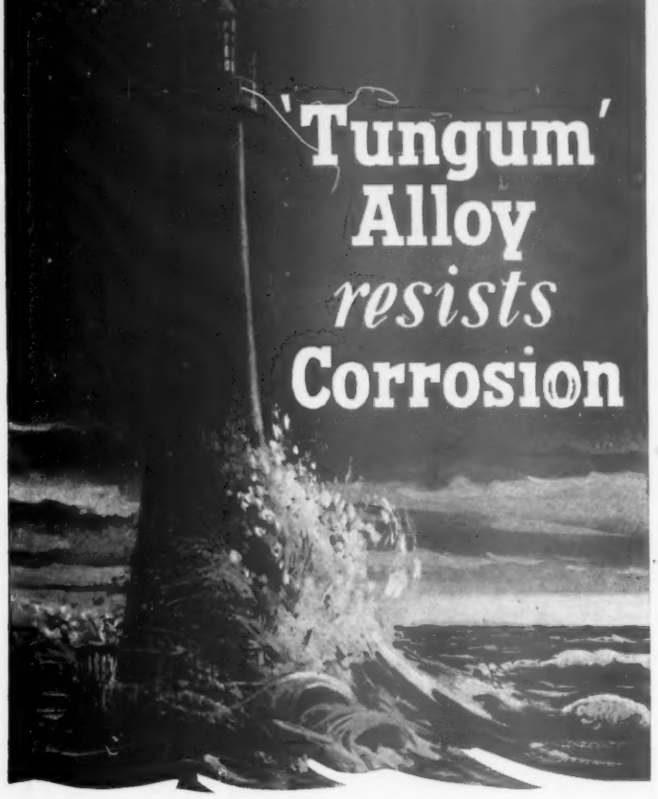

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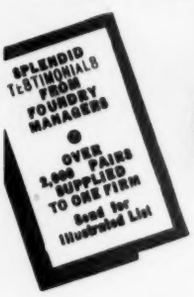

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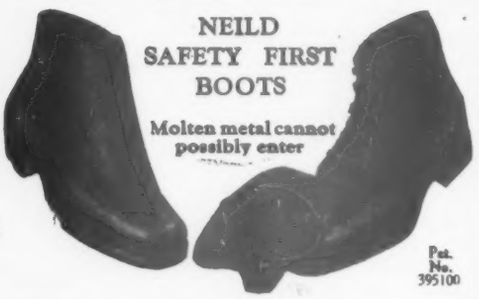

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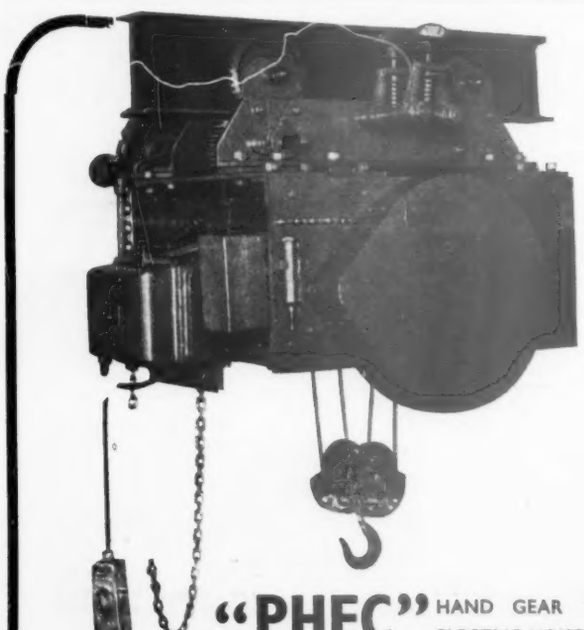

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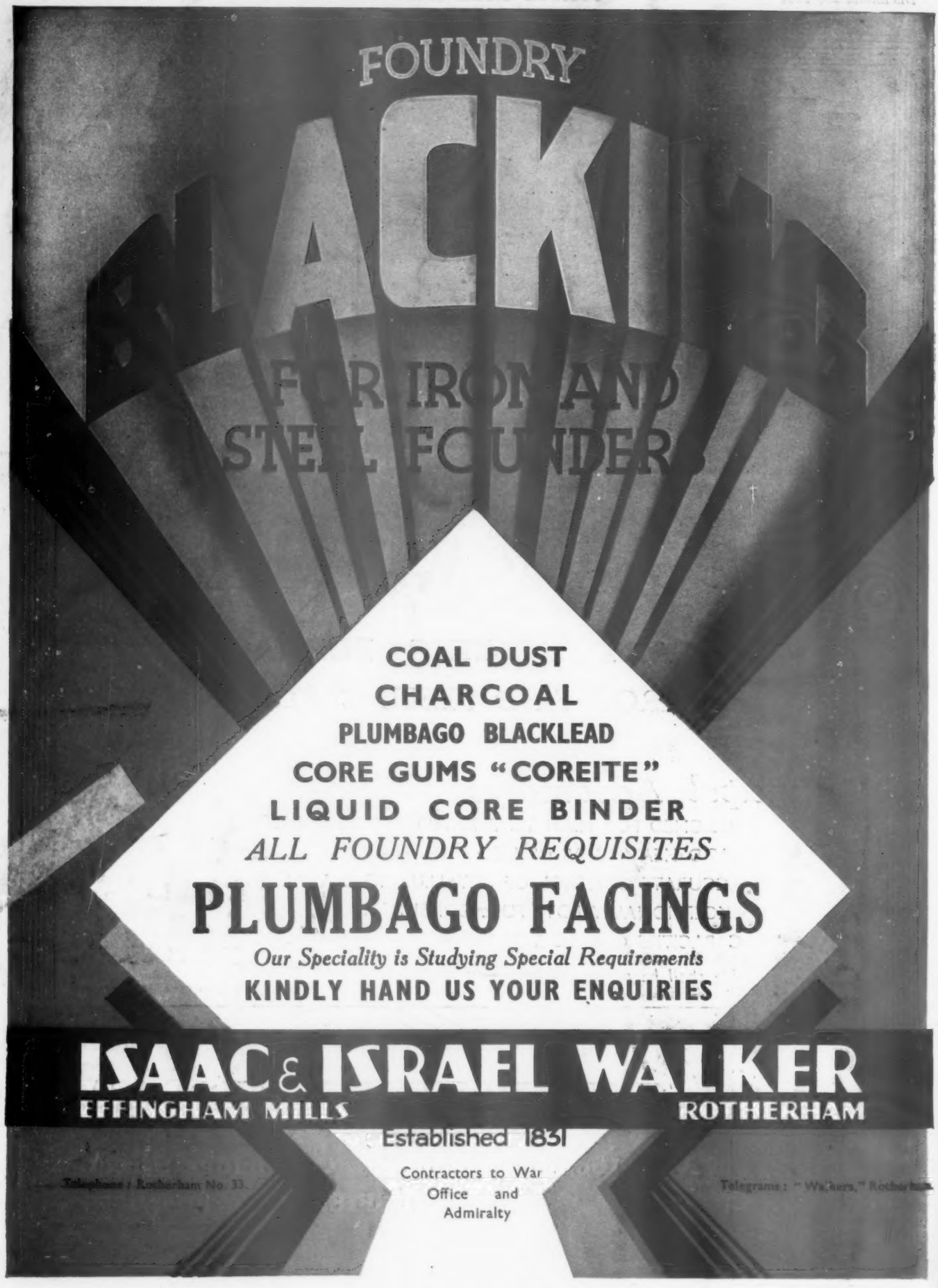
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